DOCTOR OF PHILOSOPHY

Resource recombination in firms from a dynamic capability perspective

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Award date:
2015

Awarding institution:
Coventry University
Münster University of Applied Sciences

Link to publication

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Date of Submission
March 2015

Coventry University

Fachhochschule Münster University of Applied Sciences

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A thesis completed at
Coventry University Business School
Faculty of Business, Environment and Society
Department of Strategy and Applied Management
in cooperation with
Münster University of Applied Sciences
Science-to-Business Marketing Research Centre

A thesis submitted in partial fulfilment of the University's requirements
for the Degree of Doctor of Philosophy (PhD)

Abstract of the Thesis

This research elaborates the concept of Resource Recombination in firms from a Dynamic Capability perspective. With the investigation of the role of Dynamic Capabilities in the process of Resource Recombination, this research addresses some existing shortcomings in the Dynamic Capability literature, where there is a crucial need to better understand the interrelationship between Dynamic Capabilities, the firm`s resource base, and innovation in form of Resource Recombinations. Examining the effect of a specific set of Dynamic Capabilities – namely the firm`s Sensing Capacity, Learning Capacity, Integrating Capacity and Coordinating Capacity – on Resource Recombination in firms, this research sheds light on what it is that explains the competitive heterogeneity and variance in resource value creation across firms. Addressing this issue, this research contributes to the resource and competence based research by presenting and empirically testing a conceptual model of factors influencing Resource Recombination in firms.

The conceptual model is developed based on a thorough literature review, before being further tested, refined and validated using a mixed method research approach, entailing both qualitative and quantitative research steps. Hereto, empirical data from 208 target respondents is analysed applying structural equation modelling (SEM) principles, including structural path analysis and hypothesis testing, model re-specification, as well as mediation and moderation analyses.

In line with the resource based view (RBV), empirical findings confirm that the firm`s resource endowments explain - in part - value creation in firms. But moreover this study found that the effectiveness of those resource endowments to provide productive performance outcomes depends on the extent to which firms possess specific Dynamic Capabilities: Sensing and Learning capacities are important for building the potential value of resources for Resource Recombination, while Integrating and Coordinating capacities are necessary for realising the value creation potential of those resources by developing new Resource Recombinations. Accordingly, regarding their role and effects towards Resource Recombination, two different types of Dynamic Capabilities can be distinguished: Potential Building Dynamic Capabilities and Value Realizing Dynamic Capabilities, whereby both capacity modes have complementary roles and are critical to the achievement of superior performance. Moreover, empirical evidence is given that the firm`s Entrepreneurial Orientation and Networking Orientation are important antecedents for the development of Dynamic Capabilities, and consequently Resource Recombinations.

The principal aim of this research was to bring clarity to the notion of Dynamic Capabilities, their role and effects towards building Resource Recombinations in firms. With the Dynamic Capability framework and conceptual model presented, this research offers a more precise definition of the firm`s Dynamic Capabilities, shedding light on their role and effects towards developing new Resource Recombinations and separating them from their antecedents and consequences. Therewith, this research not only contributes towards opening up the black box of Resource Recombination in firms, but moreover helps to establish Dynamic Capabilities as a theoretically, well-founded and useful construct for strategic management. By explicitly embedding the Dynamic Capability perspective in resource based explanations for value creation, this research extends the traditional focus of the RBV, working towards a more dynamic interpretation of the RBV. It thereby tries to overcome the identified limitations of past research in this field.

Acknowledgements

Within the last five years writing this PhD thesis many dear people have accompanied me, which I want to thank at this point.

First of all, I would like to express my very great appreciation and thanks to Dr. Gerry Urwin, my supervisor and director of studies at Coventry University, for his valuable and constructive suggestions and guidance throughout the PhD. I always will be grateful for your aspiring supervision, invaluably constructive feedback and friendly advice during the entire PhD project. I also would like to thank my supervisory team at Coventry University, Dr. Stefania Paladini for her time and dedication, and especially Professor Tom Donnelly for his valuable comments and feedback in revising the thesis.

Moreover, I would like to thank Professor Thomas Baaken, my supervisor at Münster University of Applied Sciences, for creating unconditional opportunities throughout the years for my personal and scientific development, breaking down any barriers given on the way, and opening new paths that have not been walked before. Without his constant support and commitment this PhD thesis simply would not exist. I would like to thank you, Thomas, for encouraging my research from the beginning and for allowing me to grow personally and as a research scientist. Your advice on both research as well as on my career have been invaluable.

I also want to acknowledge Dr. Caroline Plewa among my supervisory team, as she contributed considerably in supervising my thesis, acting as advisor and mentor and giving me professional, scientific and methodological advice, aspiring guidance and valuable feedback whenever I needed it. I thank Carolin dearly for her selfless dedication to science, her heartsome encouragement and enthusiasm, and sometimes simply for reminding me that at "a good PhD is a done PhD". You have been a tremendous mentor for me – both as scientist and lecturer, and as person and friend.

I would also like to thank Professor Mats Magnusson form the KTH Royal Institute of Technology in Stockholm for offering me a visiting researcher position and thereby giving me the opportunity for fruitful discussions, reflections and refinements of my initial research ideas.

Moreover, I would like to thank my dear colleagues and friends at the Science-to-Business-Marketing Research Centre and at noventum consulting for their valuable comments and remarks on my research. Hereby especially I want to thank Uwe Rotermund, who always supported and encouraged me in \`my work after work\` and truly opened me the path from \`science-to-business\`.

Finally, my family – the place where I belong to –, my wonderful husband Reiner, his sons Henry and Louis, and our little girl Sabeth. Words can not express how thankful I am to know you on my side. You kept me alive, retrieved me out of my 'research tunnel', and showed me what life is really there for. I also want to thank my mum for her unconditional love and support of all my doing. Your trust and faith in me have built the foundation to find my own way, and to arrive were I am today.

Within the last year of my PhD our little daughter Sabeth was born. She opened a completely new dimension of love, life, and happiness to us, indeed showing me every morning that the most wonderful, most delightful, and (I guess sometimes also) most challenging project of my life is yet to come. I am much looking forward to it. I dedicate this work to my beloved ones: Reiner, Henry, Louis and Sabeth. I love you dearly and feel blessed to have you all around me.

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II. List of Figures

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IV. List of Abbreviations

α	Cronbach’s coefficient alpha
AGFI	Adjusted Goodness-of-Fit
c.r.	Critical Ratio
CAIC	Consistent Akaike Information Criterion
CBV	Competence Based View
CFA	Confirmatory Factor Analyses
CFI	Comparative Fit Index
CMB	Common Method Bias
CU	Coventry University
DC	Dynamic Capability
DCP	Dynamic Capability Perspective
EFA	Exploratory Factor Analyses
EO	Entrepreneurial Orientation
GFI	Goodness-of-Fit
GLS	Generalised-Least-Squares
ICT	Information and Communications Technology
IT	Information Technology
KBV	Knowledge Based View
KMO	Kaiser-Meyer-Olkin measure
ML	Maximum-Likelihood
NFI	Normed Fit Index
NO	Networking Orientation
NPD	New Product Development
OECD	Organisation for Economic Co-operation and Development
PAF	Principal Axis Factoring
PCA	Principal Component Analysis
p_{η}	Construct reliability
p_{vc} (η)	Average Variance Extracted (AVE)
R&D	Research and Development
RBV	Resource Based View
RMR	Root Mean Squared Residual
RMSEA	Root Mean-Square Error of Approximation
RR	Resource Recombination
SD	Standard Deviation
SEM	Structural Equation Modelling
SIC	Standard Industrial Classification
TLI	Tucker-Lewis Index
TLI	Tucker-Lewis Index
UK	United Kingdom
B	Beta Value/ Regression Weigth
χ^2	Chi-Square
χ^2/df	Normed Chi-Square
$\Delta\chi^2$	Chi-Square Difference
ζ	Residual (Error Term)

V. Outline of the Thesis

The following section presents an outline of the thesis and describes the role of each chapter within the thesis, in order to lead the reader through the work.

Chapter one provides an introduction of this research, giving an overview of the research and providing the general focus of this PhD thesis. Besides establishing the research scope and context, the research objectives and questions addressed by this research are outlined. Moreover, a brief overview of the research approach and methodology of this research is presented.

Chapter two presents a literature review on the principal parent theories, the resource and competence based research. In this chapter, first the concept of *Resource Recombination* (RR) and its importance for economic development is discussed, based on existing literature within the wider disciplines of strategic management and entrepreneurship. Also, the theoretical foundation of this research is established, presenting evolution and background of the resource and competence based research, outlining the different streams of literature in this area of research, and demarcating them from related areas. Thereafter, to provide the conceptual foundation for the research, the status quo in literature is described, consolidating current knowledge of the core concepts relevant for this research in order to develop a mutual understanding. Subsequently, the research gaps derived from the review of current literature and addressed in this research are presented. Importantly, this chapter also identifies and defines the relevant constructs to be included in this study.

Chapter three develops the conceptual model and hypotheses for this research. By investigating the relation between the resource base, *Dynamic Capabilities* (DCs), and its performance outcomes RR, this chapter contributes to establish a better understanding of these interrelations, leading to the development of a conceptual model to be tested, refined, and validated in a following qualitative and subsequent quantitative research step. Starting with an examination of resource value creation in firms, specific characteristics of the resources and their influence for determining the potential value of the resource base for RR are described, next the DC framework is established and the role of a specific set of DCs in the process of resource value creation is further investigated. Lastly relevant framework conditions for the development of DCs are discussed. Based on the established understanding of the individual variables and their interrelationships and theoretical linkages, this chapter concludes with the presentation of the conceptual model and the hypotheses for further analysis. Doing so, this chapter provides the theoretical foundation, the determinants and framework conditions of the RR concept and outlines this research`s argument and related hypotheses.

Chapter four describes the overall research design, methodology and focusses on the qualitative findings leading to the model and hypotheses refinement. Starting with a description of the general research design, entailing both research strategy and methods, in the subsequent part this chapter focusses on describing and justifying the qualitative research methods used in this study and outlines the research findings of the first, qualitative research step. Drawing on the key finding from the qualitative research step, minor adjustments of the conceptual model are presented.

Chapter five subsequently describes the quantitative research methods, questionnaire design, and data collection process applied for empirically testing the conceptual model and hypotheses. A critical examination and justification of the data collection method is followed by a detailed description of the questionnaire design, entailing the levels of measurement, theory and statistical analysis, the operationalisation of the measurement constructs, scales and measurement items, as well as the pre-test of the survey instrument. Furthermore, the data collection process is described, outlining the sampling procedure, frame and size, as well as non-response bias.

Chapter six outlines the individual steps of data analysis and presents the quantitative research results. The conceptual model and thus the proposed interrelationships among the endogenous and exogenous constructs are tested by means of structural path analysis using Structural Equation Modelling (SEM) principles. Starting with the step of data preparation and evaluation of normality assumptions, in the following, as a result of the Exploratory Factor Analyses (EFA) and Confirmatory Factor Analyses (CFA), the *measurement model* is presented, whereby relevant issues, such as construct reliability and validity and model fit, are described. Furthermore, important concerns for SEM are presented, including goodness-of-fit indexes, one-factor congeneric measurement models, model identification, multivariate assumptions, common method bias, measurement model invariance and the calculation of composite variables. Based on the EFA and CFA results, the *structural path model* for analysing the causal relationships between the constructs is presented, and hypotheses are tested. The results are analysed and presented in three steps, namely hypotheses testing, model re-specification and moderation and mediation analysis.

Chapter seven elaborates on the results of this research, discussing and integrating all research findings regarding the role of DCs and the impact of resource endowments in the process of resource value creation through RRs in firms. Based on the discussion of the key findings, managerial implications are derived, contributions to the literature are delineated, and limitations of this research are outlined. Before concluding, suggestions for future research activities are given.

Chapter 1: Introduction

1.1 Aims and Objectives

(Lippman and Rumelt, 2003, p.1085)

In dynamic environments where fierce competition exists, the need to make efficient use of a firm`s resources is crucial. The resource based view (RBV) sees a firm`s competitive position primarily determined by the special features and quality of firm specific resources (Schreyögg and Conrad, 2006, Barney, 1991). According to the RBV, observable performance differences between firms can primarily be led back to the different resources that are available within the firm at one point in time (Freiling et al., 2006). The RBV proposes that in order to gain sustainable competitive advantage, a firm needs to own or create unique resources which are rare, valuable, difficult to imitate and non-substitutable (VRIN) (e.g. Barney, 1991, Grant, 1991, Miller et al., 1996).

However, while owning or having access to rare, valuable, hardly imitable and non-substitutable resources is necessary for a competitive advantage (Barney, 1991), they must be effectively managed and synchronised *to realise* a competitive advantage (e.g. Hansen et al., 2004, Kor and Mahoney, 2005, Holcomb et al., 2009).

In dynamic environments, where firms continuously strive to find the right match between strategic assets and strategic industry factors (Amit and Schoemaker, 1993), the resources, and the way they are being combined, must be altered if the competitive advantage is to be sustained over time (Barney, 1991, Black and Boal, 1994, Capron et al., 1998). Thus, as stated by Holcomb and colleagues (2009): "Efficient production with heterogeneous resources is a result not of having better resources but in knowing more accurately the relative productive performance of those resources" (Holcomb et al., 2009, p. 457, emphasis included in the original by Alchian and Demsetz, 1972, p. 793).

Accordingly in dynamic environments, the firm`s **Dynamic Capability**, defined as a "firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments" (Teece, 1997, p. 516), is crucial in order to develop new innovative **Resource Recombinations**.

Thus, a firm`s competitiveness stems from both its access to resources and the Dynamic Capability of the firm to reconfigure their resource base and to integrate the resources into new resource bundles. Correspondingly, the competitiveness of a firm is not only depending on the quality and complementarity of the resource base but also on the firm's Dynamic Capability to manage the process of Resource Recombination, and thereby to extract the value potential of the resources currently owned and to transform it into a realised value (e.g. new innovative resource bundles) (e.g. Barney, 1991, Wiklund and Shepherd, 2009).

Research Problem. While the concept of Resource Recombination to generate continuous innovations has been widely discussed and is recognised as significant in today's knowledge economy (e.g. Henderson and Clark, 1990, Kogut and Zander, 1992, Grant, 1996, Galunic and Rodan, 1998), the insights in the determinants and antecedents that drive Resource Recombinations in firms have still been limited (Zahra and Wiklund, 2002, Galunic and Rodan, 1998). The failure of firms to find systematic ways to identify, evaluate and successfully combine existing resources (e.g. knowledge, intellectual assets, human resources) is well documented in research, stemming from a lack of understanding of how organisations can strategically and practically approach and foster Resource Recombination as a source for continuous innovation generation (Kliewe et al., 2009). Only few publications can be found that have dedicated their work to provide recommendations on how organisations can plan and execute Resource Recombinations and what specific capabilities are needed in order to successfully implement Resource Recombinations (Sirmon et al., 2007).

Despite the high relevance of Resource Recombination and the increasing interest from academia and practice, current publications have not yet elaborated on how a possible framework for Resource Recombination in firms could be designed and established. Although the competence based research and Dynamic Capability perspective have received increasing attention in contemporary research, and Dynamic Capabilities of the firm are - by definition - linked with Resource Recombination in firms, a study that conceptually and empirically applies the Dynamic Capability perspective to the concept of Resource Recombination is lacking. Up to today, little is known about the relationship between the Dynamic Capabilities and one specific, but central organisational performance outcome: Resource Recombination in firms, which implies an urgent need for such a framework to be established.

Research Aims. This research investigates the role of Dynamic Capabilities in the process of Resource Recombination. It thereby elaborates the framework conditions of Resource Recombination in firms from a Dynamic Capability perspective. Hence, the core of this PhD research lies in the concept of Resource Recombination as a source of continuous innovation generation and the Dynamic Capabilities of a firm relevant to develop and implement new innovative Resource Recombinations.

With the investigation of the concept of Resource Recombination from a Dynamic Capability perspective, this research addresses some existing shortcomings in the Dynamic Capability literature, where there is a crucial need to better understand the interrelationship between Dynamic Capabilities, the firm`s resource base, and innovation in form of Resource Recombinations. Examining the effect of a specific set of Dynamic Capabilities on Resource Recombination in firms, this research aims to shed light on what it is that explains the competitive heterogeneity and variance in value creation across firms. This research proposes, that the resources a firm possesses are as important as the firm`s Dynamic Capabilities for Resource Recombination. Thus both, the resources as well as the firm`s Dynamic Capabilities are important, though not the only, antecedents of Resource Recombination. This argument is grounded in established theories from resources based research (e.g. Barney, 1991, Penrose, 1959, Rumelt, 1987) and competence based research (e.g. Modaschl, 2006, Teece et al., 2007). Addressing this issue, this research aims is to contribute to the academic field by presenting and empirically testing a conceptual model of factors influencing Resource Recombination in firms.

Research Objectives. Therefore, a first empirical investigation of the Dynamic Capability construct and its influence on Resource Recombination will be the object of investigation within this PhD thesis. A number of objectives will be addressed, namely:

(1) to develop a conceptual framework and measurement model of a specific set of Dynamic Capabilities relevant for the process of Resource Recombination,

(2) to empirically investigate the influence of a firm`s Dynamic Capabilities on Resource Recombinations in firms, and

(3) to examine the factors influencing the development of a firm`s Dynamic Capability to better understand how organisations can strategically foster the development of a firm`s Dynamic Capability and thus Resource Recombination in firms.

These research objectives and respective questions will be further outlined in chapter 1.3 below.

Research Contribution. The contribution this research is expected to make is to develop, apply and empirically test a conceptual model to provide a holistic, integrated picture of the influencing factors of Resource Recombination from a Dynamic Capability perspective, and thereby to open up the black box of Resource Recombination in firms. With the conceptual model presented, this research offers a more precise definition of the firm`s Dynamic Capabilities, shedding light on their role and effects towards developing new Resource Recombinations and separating them from their antecedents and consequences.

1.2 Research Scope and Context

For a long time, researchers have highlighted that not only the search for new resources, but also the usage of existing resources in new ways can be seen as an important source of innovation and competitive advantage and thereby future organisational rents (e.g. Schumpeter, 1934, Usher, 1954, Penrose, 1959, Koestler, 1964). Schumpeter was among the first to acknowledge the importance of **Resource Recombination (RR)** for value creation in firms. In his concept of creative destruction, he refers to innovations as a result of “carrying out new combinations” (Schumpeter, 1934, p. 68) pointing out that innovation often “consists to a substantial extent of a recombination of conceptual and physical materials that were previously in existence” (Nelson and Winter, 1982, p. 30). Correspondingly, literature often refers to ‘*Schumpeterian Innovation*’ or ‘*Resource Recombination*’ as “the reconceptualization of an existing system in order to use the resources from which it is built in novel and potentially rent-generating ways” (Galunic and Rodan, 1998, p. 1194, similar in Henderson and Clark, 1990, Kogut and Zander, 1992, Grant, 1996).

Taking up these fundamental thoughts of Schumpeter, current research within the field of entrepreneurship and strategic management acknowledge RRs as crucial source of innovation, by stating: “Through a reconfiguration of existing resources within the firm, or through the integration of new resources into their existing resource base, firms can introduce new products and services or enter into new markets” (Wiklund et al., 2002, p. 152). This notion incorporates that the resources to be bundled into new RRs can either be developed internally and/or sourced externally (Wiklund and Shepherd, 2009). Following Holcomb et al. (2009, p. 458, going back to Peteraf and Barney, 2003, Sirmon et al., 2007), “resource bundles represent unique combinations of resources that enable firms to take advantage of specific market opportunities when effectively deployed”.

Over the last decades, studies within the resource and competence based research particularly stressed the crucial importance of RRs as means of creating wealth (Wiklund et al., 2002). A considerable amount of studies have been published within the RBV, which linked RRs to future wealth creation and thereby made a first step to analyse the causalities between RR and firm success (Grant, 1991, Miller and Shamsie, 1996, Rouse and Daellenbach, 1999, Teece et al., 1997). Nowadays there is agreement among researchers that new RRs generate novel products, goods and services (as defined by Majumdar, 1998, Penrose 1959) that give firms competitive advantages (McGrath et al., 1995) and enables to create wealth (Grant, 1991, Teece et al., 1997).

Further research has shown that RRs can be used as an indicator of current entrepreneurial activities within the firm (Brown et al., 2001, Guth and Ginsberg, 1990, Lumpkin and Dess, 1996, Stopford and Baden-Fuller, 1994). Following Grant (1991), the combination of resources itself can be seen as a major source of the competences firms develop and own to reach their goals, particularly in emerging industries. Moreover, since the outcomes of '*Schumpeterian Innovation'* are predominantly radical and disruptive in nature, researchers admit the recombination of resources as being an important source of novelty and firm innovation (Galunic and Rodan, 1998). Being innovative by searching and finding out new RRs constitutes the basis for future organisational rents (Galunic and Rodan, 1998) and in consequence can determine market winners and losers (Foster, 1986).

Nowadays in rapidly changing and dynamic markets, it becomes even more essential for firms to be entrepreneurially active by searching for new RR opportunities (Wiklund et al., 2002, Wiklund and Shepherd, 2009). If the competitive advantage is to be sustained over time, resources and the way they are bundled must be changed to adapt to the ever changing, unpredictable environments (Holcomb et al., 2009, Hawass, 2010, Eisenhardt and Brown, 1999). Accordingly, a strong desire exists - within both the resource and competence based research - for understanding how companies can successfully recombine existing resources within the firm in new ways and (or) integrate new resources within their existing resource base to leverage their assets.

Contemporary entrepreneurship and strategic management scholars have indeed shown a strong interest in encouraging firms to innovate by searching out new innovative RRs or new ways of using existing resources (Galunic and Rodan, 1998, Wiklund et al., 2002). However, until recently researchers within the RBV have remained detached from strategic concerns on how these resources are combined, and what factors are influencing the likelihood of RRs in firms. While past research has targeted to catalogue different types of resources and relate them to value and wealth creation (Barney, 1991, Rouse and Daellenbach, 1999), little attention has been given to understand the process on how these resources are recombined into new innovative resource bundles and what capabilities are needed within the firms (Zahra and Wiklund, 2002). Instead, the focus of previous studies within the RBV predominantly were centred in the investigation of the importance of RRs for wealth creation. Until recently, both strategic management and entrepreneurship research remained anchored to a view that sees wealth creation primarily influenced by the resources itself, ignoring the wider aspects of what abilities and competences a company needs to have in order to manage these resources and bundle them into new innovative RRs and thereby leverage the RR opportunities.

To encounter these limitations and to overcome the relatively static perspective of the RBV, which does not consider market dynamisms, a more recent stream within the competence based research has been established, where researchers incorporate a more dynamic perspective of a firm`s resources. In contrast to the RBV, the competence based view (CBV) sees competitive advantages not solely deriving "mechanically" from the availability and quality of resources (respectively RRs), but rather from the ability to utilise these resources (Moldaschl, 2006) and adapt them to changing environments (Teece et al., 1997). One important stream in the CBV is the Dynamic Capability literature. Drawing on the CBV, the literature following the Dynamic Capability perspective sees the ability of a firm to reconfigure its resource base - referred to as the **Dynamic Capability (DC)** of the firm - as the key source of competitive advantages in dynamic environments (Eisenhardt and Martin, 2000, Teece et al., 1997, Mathews, 2002). More specifically, Teece et al. (1997, p. 516) refer to a firm`s DC as a “firm’s ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments”. Eisenhardt and Martin (2000) argue that a firm`s DC enables the development of new RRs. The underlying assumption of the DC perspective is that firms that reconfigure their resources faster than their competitors are more likely to receive a competitive advantage and thus superior performance (Isobe et al., 2008). Thus, the emphasis of this stream of research lies especially in the investigation of how firms can sustain their competitive advantage in rapidly changing, dynamic environments.

More recent works proposed by researchers have shown an increased interest in the importance of RR for innovation generation from this DC perspective (e.g. Hawass, 2010, Pavlou and El Sawy, 2011). However, it still is a rather small group of researchers - predominantly coming from the entrepreneurship spectrum - who set out to investigate RRs from this DC perspective. They started to focus on how entrepreneurial RR activities can be stimulated, fostered, and maintained within organisations (Brown et al., 2001, Eisenhardt and Martin, 2000, Galunic and Rodan, 1998, Wiklund et al., 2002). While traditionally research on entrepreneurship has examined, how characteristics of the individual influence strategic management choices and firm performance (Venkataraman, 1997), a few studies (e.g. Wiklund et al., 2002, Hawass, 2010, Galunic and Rodan, 1998) emphasise a shift towards the examination of how characteristics of groups as well as organisational characteristics can influence the development of DC and thus the likelihood of firms to create RRs. Wiklund et al. (2002) for example concentrated their research on how management practices and characteristics influence the likelihood of RRs to occur, suggesting that – independently from the resource base – certain factors such as *Strategic Orientation, Entrepreneurial Culture, Management Structure, Resource Orientation, Growth Orientation and Reward Philosophy* can promote and facilitate entrepreneurial RR activities. Another study presented by Hawass (2010) explored the determinants of the reconfiguration capability from a DC perspective, and concentrated on how the individual, group and organisational level of learning influences the development of the firm`s capacity to reconfigure its resources. Also in their qualitative study, Galunic and Rodan (1998) presented valuable propositions on how the properties of knowledge and its social organisation in the firm may influence the likelihood of RR in firms.

A homologue progress can be found in the strategic management literature, where for instance the work by Schreyögg and Kliesch (2003) addressed the organisational competence, referred to as the organisation`s ability to implement the process of resource selection and recombination and its importance for making use of its resources. However their investigations remains only on a conceptual level. Similar attempts, though only on a qualitative level, have been made by Sirmon et al. (2007), who investigated different stages in the resource management process in order to effectively bundle resources into valuable RRs.

In consequence, although the competence based research and the DC perspective have received increasing attention in contemporary research, and the concept of DC is - per definition - linked with the process of RR in firms, a study that conceptually and empirically applies the DC perspective to the concept of RR is still lacking. To date, no study of which the author is aware, has investigated the relationship between the DCs and one specific, but central organisational performance outcome: RR in firms. While first attempts towards an investigation of certain factors that influence RR has been made, still this stream of research is in the early stages of development and needs to be further investigated.

Summarising, the above outline has shown that strategic management and entrepreneurship researchers share a common and strong interest in value and wealth creation through RR in firms as it is regarded as important source for continuous innovation generation and sustained competitive-ness. Following Hitt and Ireland (2000) "RC [resource (re)combination - author`s note] is an important issue where strategic management and entrepreneurship intersect and where fruitful integrative research can be carried out" (Zahra and Wiklund, 2002, p.10).

1.3 Research Objectives and Questions

Research Objectives

In order to address the research gaps defined below in the literature review, and thereby to lift and fully exploit the potential of the RR approach for innovation generation, this research sets out to contribute to the academic field by developing and quantitatively testing a theoretical model of the factors that influence RR in firms. Since no holistic model is known to be existent thus far that integrates the factors that influence RR from a DC perspective, this research aims to provide a comprehensive quantitative model of the influencing factors of RR in firms. Doing so, the **overall aim** of this research is to investigate the DCs of the firm and their influence on one specific performance outcome: RR in firms, and thereby to bring clarity to the notion of DCs, their role and effects towards RRs in firms.

The **overall objective** of this research is to investigate the role of DCs in the process of RR in firms and thereby to elaborate the framework conditions of RR in firms from the DC perspective. More precisely, this research investigates the DCs in relation to the resource base and thereby explores how the two constructs work together towards developing RRs in firms. The **objectives of this research** are:

(1) to develop a conceptual framework and measurement model of a firm`s DCs, by (a) identifying and conceptualising a set of DCs relevant for the process of RR, (b) describing the underlying activities, processes and routines of the identified capabilities, and (c) operationalising and developing a measurement model for the DCs to develop a comprehensive understanding of the DC construct.

(2) to empirically investigate the influence of firm`s DCs on RR in firms, in particular to understand how the specific DCs act upon the resource base by building and exploiting it, and how both constructs are linked with the organisational outcome of new resource combinations. The aim is to bring clarity to the notion of DCs, and their role and effects towards developing RRs in firms.

(3) to examine the firm and network-level antecedents for the development of a firm`s DCs. The aim is to understand to what extend the firm`s strategic orientation (observed on the organisational and inter-organisational level) influences the development of DCs and thus RRs.

With the conceptual model presented, this research offers a more precise definition of the firm`s DCs, shedding light on their role and effects towards developing new RRs in firms and separating them from their antecedents and consequences. Moreover, a set of hypotheses are presented outlining (1) how the resource base and the DCs are related to one another, (2) how the relationship between the resource base and RRs is moderated by a firm`s DCs, (3) how the firm`s strategic orientation affects the development and utilisation of DCs for RRs. It is suggested that focusing on specific DCs of the firm, their role and effects, can offer valuable insights into the source of variance in organisational performance outcomes.

Research Questions

Correspondingly to the research objectives, the **research questions** this PhD research aims to answer can be described as the following:

First, in order to address research objective (1), the construct of DC will be subject of investigation. Therefore, a specific set of observable and measurable DCs for the process of resource selection and reconfiguration has to be identified, described, operationalised and measured. Specific research questions originated from the review of literature would be:

(1) How can a Dynamic Capability Framework be described, operationalised and measured?

(1.1) What specific capacities are needed in firms to integrate, build and reconfigure internal and external resources to address rapidly changing environments? How can the different types of capabilities be described, categorised and aligned? How can a framework be derived with a set of generic types of capacities?

(1.2) What are the underlying activities, processes and routines of the identified set of capabilities?

(1.3) How can the identified set of capacities of a firm be operationalised and measured?

Second, in order to address research objective (2), after the first operationalisation of the construct of DC, its influence on the development of RRs in firms will be empirically investigated. For this purpose a conceptual model will be developed and qualitatively validated using expert interviews with industrial representatives. In the second, quantitative research step this model will be empirically tested. Specific research questions are:

(2) What influence have Dynamic Capabilities on RRs in firms?

(2.1) What is the role and effect of the different DCs in the process of RR? More specifically, are different types of DCs working on different levels (e.g. building and exploiting the resource base)?

(2.2) Do certain characteristics of the resource base (e.g. quality, diversity, complementarity, transferability, deployment flexibility, renewal) influence the potential value of the resource base for RR in firms?

(2.3) What is relatively more important for RR in firms, the resources endowment or the DCs of the firm? Or does one not go without the other?

Third, in order to address research objective (3), the influence of specific firm- and network-level antecedents on the development of firm`s DCs will be further investigated. More specifically this research addresses, how a firms` Entrepreneurial Orientation (firm-level), and its Networking Orientation (network-level) influence the development of a firm`s DC. Specific research questions are:

(3) What is the influence of a firm`s Entrepreneurial Orientation and Networking Orientation on the development of the firm`s DCs?

(3.1) Does a higher degree of entrepreneurship in firms positively influence the development of a firm`s DCs?

(3.2) Is there a positive influence of a high Networking Orientation on the development of DCs?

(3.3) What is relatively more important? Are they complements or substitutes?

Based on the advanced understanding of the specific DCs, their role and effect, and antecedents for building RRs in firms, systematic ways for the development of DCs in order to successfully implement RRs in a firm`s innovation strategy can be derived. The aim is to provide practical applicable implications for managers on how to strategically foster RR in firms. The challenge here will be to identify and localise the determining coordinates that constitute the shape of a promising theory, and to connect them in order to draw a more clear and outlined orientation map. By doing so, a foundation can be built that fosters RR activities within and between companies.

1.4 Research Approach and Methodology

Based on the resource and competence based research as well as literature from the strategic management and entrepreneurship spectrum, a mixed-method approach research is conducted. The aim is to create research that can be practically applied whilst also robustly defended in a research environment, through a thorough literature review, qualitative and quantitative research methods, and a model validation process.

This study starts with a comprehensive literature review, aiming to establish the research context. Discussing theories as well as empirical findings in the wider field of RR. The literature review will provide the theoretical and conceptual foundation for the development of a conceptual model and delineates the research gaps addressed in this research. Discussing important characteristics of the resource base and providing a detailed elaboration of the DC construct, a DC framework will further be presented, that allows a first operationalisation of the construct of DC, and its influence on RR. Moreover, the antecedents for the development of the DC will be the subject of investigation. Based on the extensive literature review, the conceptual model and hypotheses will be derived.

The second, qualitative research step will be undertaken to further specify the conceptual model (exploratory research). The major research technique for this research step will primarily be in-depth interviews with key informants from industry engaged in RR projects. Based on the newly gained knowledge, the conceptual model and hypotheses will be adjusted and if necessary refined.

In the third, quantitative research step, the theoretical model and respective hypotheses will be tested by conducting empirical research. For this purpose, the model`s constructs will be operationalised and included in an online survey, distributed to upper or middle management personnel working in innovation-related functional areas in the UK. The data collected will be analysed statistically based on structural equation modelling (SEM) principles, resulting in an empirically validated model of factors influencing the likelihood of RR. A more detailed description of the research design and the methodology is provided in chapter four.

Chapter 2: Literature Review - Theoretical and Conceptual Foundations

2.1 Introduction

The following chapter provides a literature review on the resource and competence based research as parent theories for this research. The aim of this literature review chapter is to present an overview on the status quo in literature with respect to the economic relevance of the concept of Resource Recombination (RR) for strategic management and entrepreneurship, the resource and competence based research as parent theories for the concept of RR, together with a view on its background, evolution and demarcation of the research area. Moreover this chapter sets out to introduce a general understanding of the core concepts relevant for this research.

The first section starts with the contextual integration of the RR concept within the wider discipline of strategic management and entrepreneurship, displaying and discussing the economic value and relevance of the concept of RR for future wealth creation, based on existing literature.

The next section provides an overview of the resource and competence based research, recognised as the parent theories for the concept of RR. Therefore, firstly the evolution and historical background of resource and competence based research will be described, thereafter the resource based view (RBV), the competence based view (CBV), as well as the related knowledge based view (KBV) are described, outlining the different streams in literature, and demarcating them from related areas. The section closes with an overview of the theoretical bases and approaches of the resource and competence based research.

Having established the theoretical foundation of this research, the subsequent section provides the conceptual foundations of this research. In this section the status quo in literature is described, presenting the current knowledge of the core concepts relevant for this research in order to develop a mutual understanding and deduce the central definitions for this research. This section identifies the relevant constructs to be included into this study.

In the last section, based on the thourough understanding of existing concepts, the research gaps derived from literature that will be further addressed in this research are presented and discussed.

The primary contribution of this chapter is to provide the theoretical and conceptual foundation of the concept of RR and DCs of the firm, and embedding it within the wider discipline of strategic management and entrepreneurship.

2.2 The Concept of Resource Recombination in Firms

The concept of RR has drawn significant attention in contemporary research within the strategic management and corporate entrepreneurship spectrum. Research within both these disciplines realise an increasing shift in emphasis from the market based view, more specifically the structure-conduct-performance paradigm that arose from industrial organisation economics, towards theories that rather focus on the management of internal resources of firms being the key determinant in order to gain competitive advantage (Amit and Schoemaker, 1993, Galunic and Rodan, 1998, Teece et al., 1997).

Contemporary research, both from entrepreneurship and strategic management scholars, once more concentrates on entrepreneurial activities as originally defined by Joseph Schumpeter (e.g. Eisenhardt and Martin 2000, Stopford and Baden-Fuller, 1994, Teece et al., 1997), developing towards a 'neo-Schumpeterian theory of the firm` (Teece, 2007). Schumpeter was among the first to acknowledge the importance of RR for value creation, referring to his concept of creative destruction innovations being a result of "carrying out new combinations" (Schumpeter, 1934, p. 68). Schumpeterian innovation, which is used synonymous to 'Resource Recombination', therefore often "consists to a substantial extent of a recombination of conceptual and physical materials that were previously in existence' (Nelson and Winter, 1982, p. 30). Schumpeterian innovation emerges through the re-conceptualisation of an existing system, using the resources from which it is built in new and potentially rent-generating ways (e.g. Grant, 1996, Henderson and Clark, 1990, Kogut and Zander, 1992). With regard to its outcome, innovation as defined by Joseph Schumpeter is "primarily radical and disruptive in nature" (Galunic and Rodan, 1998, p. 1194). The main point of his definition is the prescribed role of firms as the developer of novel resources. Accordingly, it is essential for firms to be entrepreneurially active by searching for new RR opportunities (Wiklund et al., 2002). Being innovative by searching and finding new RRs constitutes the basis for successful firms (Galunic and Rodan, 1998). These ideas were taken up by researchers, proposing concepts such as architect-tural innovation (Abernathy and Utterback, 1978, Henderson and Clark, 1990), combinative capa-bilities (Kogut and Zander, 1992), and configuration competence (Henderson and Cockburn, 1994).

Interestingly, a major change of paradigm can be observed within current innovation research, where innovation until recently was primarily seen as the result of basic science (search for new knowledge) or continuous improvement (Kliewe et al., 2009), and nowadays is progressively shifted towards a neo-Schumpeterian view of innovation generated through RR. Hence, in present economy the high relevance of RR for innovation generation has been rediscovered. Matthias Horx, founder of the *Zukunftsinstitut* in Germany, described this ongoing process by the following allegory:

> *"Likewise in a jungle, at some point in time, every colourful butterfly, worm and liana will have been 'invented', the future of technology lies, especially in the variation and recombination"* (Horx, 2011, p. 195).

Basically emphasising, that in today's knowledge economy, firms do not need to reinvent the wheel, but rather have to learn how to innovate by reconfiguring existing resources in new ways in order to create new recombinant innovations through the intelligent (re)combination of existing knowledge. In consequence, according to current research findings, the innovation process is mainly determined by synthesising, coupling and crossing already existing knowledge and experience, rather than being predominantly guided by radical breakthroughs (Horx, 2011, Burnett, 2009).

Taking up the fundamental thoughts of Schumpeter, current research within the field of entrepreneurship and strategic management define RRs as a crucial source of innovation, stating that "through a reconfiguration of existing resources within the firm, or through the integration of new resources into their existing resource base, firms can introduce new products and services or enter into new markets" (Wiklund et al., 2002, p. 152, referring to Schumpeter, 1934). Also, empirical evidence confirming this assumption is given, Gassmann and Enkel (2006) for example confirmed that 80% of all innovations are based on existing knowledge, technologies, products and service. Hence, innovation mainly occurs through the recombination of resources (Schumpeter, 1934, Kogut and Zander, 1992), which are unevenly distributed among firms (Penrose, 1959).

Thus, researchers acknowledge the value creation potential of RR, admitting that "in achieving new resource recombinations, firms can combine existing skills with new resources, thereby reconfiguring their resource inputs to be more efficient (…) [or] in pursuit of new initiatives such as introducing new products or entering new markets (Wiklund and Shepherd, 2009, p. 196). Accordingly, the efficient and creative use of internal and external resources and capabilities provide various innovation opportunities (Kliewe et al., 2009, Lerdahl, 1999). Following Holcomb et al. (2009) from a firm's perspective, value is created by developing new resource bundles, which allow firms to create novel tasks, services, products or processes, and which are perceived to produce greater value and utility or lower costs of usage. Nowadays, there is agreement among researchers that new RRs generate novel products, goods and services (Majumdar, 1998, Penrose, 1959) that give firms competitive advantages (McGrath et al., 1995) and enable fims to create wealth (Grant, 1991, Teece et al., 1997).

To illustrate the high economic relevance of RRs in today's economy, one of the most frequently mentioned innovations of the last decade, the iPod invented by Apple Inc., can be adduced as a good example of a successfully implemented RR (Van Rijnbach, 2010). Indeed, though the recombination of already existing resources and technologies, namely the MP3 technology[1], the touch screen technology[2], its design and functionality[3], and lastly its business model with iTunes[4], a completely new product was developed and successfully leveraged in the market. Taken the iPod as an example, it emerges that the realised value of this new invention only became apparent, after the individual resources have been successfully combined. Given that the process of RR involves uncertainty and great parts of the realised value are observed as being serendipitous and unforeseen a priori (Graebner, 2004), the total value created through RR is often not recognised until the resources have been bundled (Denrell et al., 2003, Moran and Ghoshal, 1999, Wiklund and Shepherd, 2009).

Moreover, studies in strategic management and entrepreneurship research particularly stressed the crucial importance of RRs as a means for wealth creation (Wiklund et al., 2002). Authors of several studies have shown that RR can be used as an indicator of current entrepreneurial activities within firms (Brown et al., 2001, Guth and Ginsberg, 1990, Lumpkin and Dess, 1996, Stopford and Baden-Fuller, 1994). Following Grant (1991), the combination of resources can be seen as a major source of competences that firms develop to reach their goals, particularly in emerging industries. RRs in consequence can determine market winners and losers (Foster, 1986).

Especially worthy of mention are studies from the RBV, which linked RRs to future wealth creation (Grant, 1991, Miller and Shamsie, 1996, Rouse and Daellenbach, 1999a, Teece et al., 1997) and thereby made a first step to analyse the causalities between RR and firm success. Nevertheless, only few empirical research studies applying the RBV have been conducted to date (Miller and Shamsie, 1996, Pavlou and El Sawy, 2011). While past research has targeted to catalogue different types of resources and related them to value and wealth creation (Barney, 1991, Rouse and Daellenbach, 1999), little attention has been given to understand the process on how these resources are combined (Zahra and Wiklund, 2002). Contemporary entrepreneurship and strategic management scholars have indeed shown a strong interest in encouraging firms to innovate by searching out new innovative RRs, or new ways of using existing resources (Galunic and Rodan, 1998, Wiklund et al., 2002). However, apart from a few notable exceptions (e.g. Wiklund et al., 2002, Sirmon et al., 2007), researchers have remained detached from strategic concerns on how these resources are combined,

[1] The origin of the MP3 technology goes back to the 1987 when the Fraunhofer Institute in Germany started to research Digital Audio Broadcasting, which resulted in the development of the first, however unsuccessful, MP3 player in the early 1990s. The standard was released by the Moving Picture Expert Group in 1993 (Van Rijnbach, 2010).

[2] The original idea for the touch screen technology was invented by Jason Ford of Elo Touch Systems (formally EloGraphics) in the 1970s (Van Rijnbach, 2010).

[3] Apple confirmed that the design and technology of the iPod was originally invented and patented in 1979 by Kane Kramer, a British inventor. The patent expired in 1988, when the idea fell in public domain (Van Rijnbach, 2010).

[4] The business model of online music stores, for example by MusicNet and Pressplay, already existed before Apple Inc. reinvented it (Van Rijnbach, 2010).

and what factors are influencing the likelihood of RR. Instead, the focus of previous studies within the strategic management and entrepreneurship spectrum predominantly lay in the investigation of the importance of RR. Until recently both strategic management and entrepreneurship research remained anchored to a view that sees wealth creation primarily influenced by the resources themselves, ignoring the wider aspects of what abilities and competences a firm needs to have in order to leverage these RR opportunities.

Notably, recognising the value of RR for future wealth creation, there is a current shift from investigating the importance of RR towards an investigation of how RR can be fostered. Researchers from different scientific disciplines have acknowledged that further research of the abilities and competence a firm needs to have in order to successfully implement RRs is needed to better understand how firms can appropriately carry out the RR process. Therefore, within the last decade researchers started to analyse individual and organisational factors that influence RRs in firms (Galunic and Rodan, 1998, Brown et al., 2001, Eisenhardt and Martin, 2000), addressing (i) *individual competences*, e.g. peoples` absorptive capacity (Cohen and Levinthal, 1990), (ii) *group competences*, e.g. top management team characteristics (Zahra and Wiklund, 2002), or (iii) *organisational competences*, e.g. organisational collaborative capacity (Oelsnitz and Graf, 2006), organisational interpretation capacity (Schreyögg and Kliesch, 2003), or organisational combination skills (Peitz, 2002), that are needed to successfully create RRs.

While traditionally research on entrepreneurship concentrated on how characteristics of the individual influence strategic management choices and firm performance (Venkataraman, 1997), a few studies emphasise a shift towards the examination of how characteristics of groups as well as organisational characteristics influence the likelihood of firms to create RRs. Investigating how entrepreneurial RR activities can be stimulated, fostered, and maintained within organisations and assuming that, independently from the resource base, certain factors can promote and facilitate entrepreneurial RR activities. The study of Wiklund and colleagues (2002) for example concentrated on how management practices and characteristics influence the likelihood of RR to occur. Referring to earlier findings within the entrepreneurship spectrum (e.g. Guth and Ginsberg, 1990, Lumpkin and Dess, 1996, Stopford and Baden-Fuller, 1994, Teece et al., 1997), their findings confirmed that management practices have a significant influence on the likelihood of RR, for instance by making it possible for employees to take entrepreneurial initiatives and by rewarding such efforts (Wiklund et al., 2002). Likewise, the work of Zahra and Wiklund (2002) examined how top management team characteristics influence the likelihood of RR. Their findings suggest that teams, rather than single entrepreneurs, lead most firms (Hitt and Ireland, 2000, Kamm et al., 1990) and confirm that the top management teams` alertness, innovativeness, and growth orientation significantly influence the likelihood of RR.

Other studies suppose that not only the competence of individuals or groups, but rather the competences of a whole organisation are crucial for successful RR. The conceptual work presented by Schreyögg and Kliesch (2003) for instance goes one step further looking at the organisational level and investigating the 'organisational competence', which they define as the complex, systematic selection and recombination capacity, and considers it as elementary for making use of a firm`s resources. According to Schreyögg and Kliesch (2003), the three dimensions of organisational competence involve (i) the organisational interpretation capacity, (ii) the organisational cooperation skills and (iii) the organisational combination competence, which in turn is influenced by the determining factors, namely the organisational structure, the organisational learning ability and the organisational culture. However, the work by Schreyögg and Kliesch (2003) only presents a conceptual investigation of the construct of organisational competence. An empirical investigation would be of particular interest.

While a lot of conceptual advancements have been made towards developing a better understanding of RR in firms, it emerges that up to today relatively few studies have connected individual and organisational competences to the concept of RR. Still, this stream of research is in the early stages of development and has to be further investigated. To date no study, of which the author is aware, has empirically applied the DC perspective on the concept of RR. Accordingly, a special emphasis lies in understanding what competences and capabilities are needed to combine resources for value and wealth creation (Galunic and Rodan, 1998, Moran and Ghoshal, 1996, Rumelt, 1987).

Summarising the above findings, both strategic management and entrepreneurship researchers share a common and strong interest in value and wealth creation through RRs. Following Hitt and Ireland (2000) 'RC [resource (re)combination - author`s note] is an important issue where strategic management and entrepreneurship intersect and where fruitful integrative research can be carried out' (Zahra and Wiklund, 2002). While the focus of contemporary research within the research field of RR goes apart from the investigation of the resources a firm owns towards an investigation of how these resources can be used in new, rent regarding ways and subsequently what competences are needed. Even within the internally focused resource based research, there is a shift from an observation of which and why resources may be valuable towards an exploration of how these resources (resp. RRs) may be generated (Henderson and Cockburn, 1994, Moran and Ghoshal, 1996, Teece et al., 1997) and therefore especially what competences and capabilities are needed for the process of RR. The focus lies not solely on the resource base anymore (as implied by the RBV), but rather investigates the abilities and competences of a company to make use of its resources (refereeing to the CBV).

2.3 Theoretical Foundation: Resource and Competence based Research

Being a central part of the strategic management doctrine, the concept of RR significantly contributes to the resource and competence based research. As the basis for a detailed examination of the RR concept, the resource and competence based research will be outlined in the following section as the parent theories for this research. Therefore, first the historical evolution and background of the resource and competence based research will be addressed, furthermore a demarcation of the research area will be given including a detailed description of the resource based view (RBV), the competence based view (CBV), and the knowledge based view (KBV).

2.3.1 Evolution and Background

Traditionally the monographs of Penrose (1959) and Selznick (1957) are considered as being the origin of thoughts in literature, later termed as resource and competence based research (Kor and Mahoney, 2004). Since the early 90`s there is a notable change of direction within the strategic management theory. From a broader perspective, a general shift of emphasis from the market based research towards the resource and competence based research of strategic management can be proclaimed (Amit and Schoemaker, 1993, Galunic and Rodan, 1998, Teece et al., 1997). While the focus of the market based view (MBV), as the name implies, promotes the market oriented view of the external environment of the firm, this stream in literature is predominately characterised by the publications of Michael E. Porter, who attributes the success of the competitive strategy of a firm primarily to the industry structure it is active in and to its strategic behaviour (Porter, 1980).

However, as a variety of empirical investigations could not prove the exclusive influence of the industry structure and because of the continual and rising change in the market environment, several research findings inclined towards a rejection of the traditional MBV. One of the main criticism of the MBV thereby is, that the internal structure, resources and capabilities of a firm are mostly neglected. With the aim to overcome this inadequacy, a general orientation towards the resource and competence oriented perspective of the firm emerged and has received growing attention from literature since the early 1990`s up to today (Freiling et al., 2006). Within this perspective, the focus shifted from the success of a single product to the success of the whole company. Existing resources and competences within firms thereby have shifted into the centre of attention. Innovation has been identified as the driving factor for growth. Innovative firms are generally directed towards growth, orientated on competences, potentials and resources (Plinke, 2002).

The MBV will not be subject of further investigation within this research, although, especially from an evolutionary perspective, it is deemed valuable to understand the change of direction from a more external towards the internal perspective of the firm. Contrasting the different aspects of the MBV, RBV and CBV, the following table provides a compressed overview of differences between the market oriented approach and the resource and competence oriented approach.

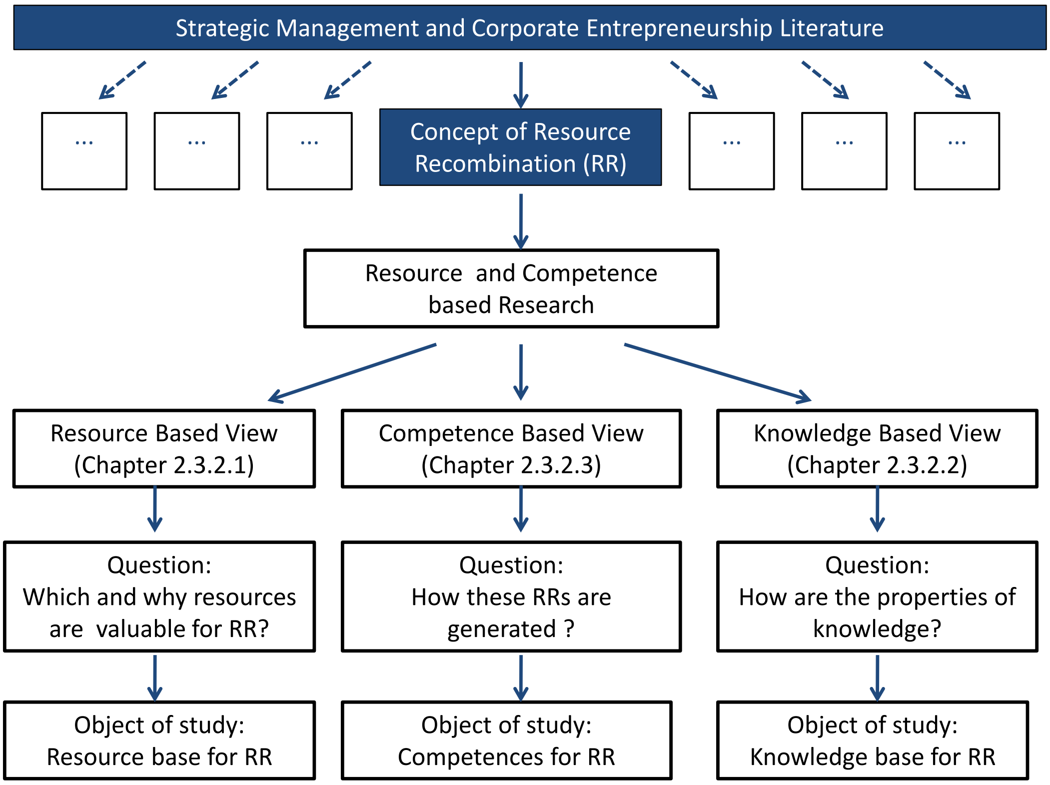
Table 2.1 Comparison of the Market oriented Approach and the Resource and Competence oriented Approach

Source: adopted from Krüger and Homp (1997), p. 63

2.3.2 Demarcation of the Research Area

Being a central part of the strategic management doctrine, the concept of RR significantly contributes to both streams, the resource based view and the competence based view of the firm. The resource and competence oriented research itself can be differentiated within the structural school (e.g. Moran and Ghoshal, 1996, Rumelt, 1987) referring to the original resource based view (RBV) by Grant (1991), and the process school referring to the later competence based view (CBV) by Moldaschl and Fischer (2004). The knowledge based view (KBV) originally founded by Demsetz and Stigler (1973), which leads back to the Chicago Business School, can be integrated and regarded as a more elementary school. Figure 2.1 attempts a generic integration of the concept of RR in the wider disciplines of strategic management and entrepreneurship.

Figure 2.1 Theoretical Foundation of this Research



Source: own illustration

2.3.2.1 The Resource based View

The **resource based view (RBV)** of the firm is a school of thoughts that has its origin in the strategic management literature. The RBV denotes the constitution and orientation phase of the resource and competence based research and can be traced back to the origin approach of Grant (1991), who introduced the 'Resource-based Theory of Competitive Advantages' (Freiling et al., 2006). With the initial publication of Wemerfelt (1984), the RBV as a central approach within the resource and competence oriented research received its name. Later on the 'Resource Advantage Theory' by Hunt and Morgan (1996), the publication 'Firm Resources and sustained Competitive Advantages' by Barney (1991), as well as the more industry economical interspaced 'Resource Dependence Approach' by Pfeffer and Salancik (1978), which has been further developed by Mahoney (1995), significantly contributed to the RBV and can be seen as the constituting publications of the RBV.

In contrast to the MBV, the RBV sees a firm`s competitive position primarily determined by the special features and quality of firm specific resource bundles (Schreyögg and Conrad, 2006). Accordingly, the RBV considers a firm as a bundle of resources (Penrose, 1959, Wernerfelt, 1984, Peteraf, 1993, Barney, 1991) and regards the firm`s distinctive resources as the direct sources of sustainable competitive advantage (Isobe et al., 2008). According to the RBV, observable performance differences between firms can primarily be lead back to the different resources which are available within the firm at one point in time (Freiling et al., 2006). The RBV proposes that in order to gain sustainable competitive advantage, a firm needs to own or create unique resources which are rare, valuable, difficult to imitate and non-substitutable (Barney, 1991).

Later on, the 'Resource Advantage Theory' by Hunt and Morgan (1996) supplemented the initial thoughts by Wemerfelt (1984), proposing that a company`s marketplace position and thereby financial performance, results from a comparative advantage (disadvantage) in resources. Hunt and Morgan define resources as tangible entities (e.g. specific machinery) and intangible entities (e.g. skills and knowledge of individual employees) which are available in firms and enable them to produce efficiently and/or effectively market offerings of value for some market segments (Hunt and Morgan, 1997). The 'Resource Advantage Theory' thereby expands the concept of resources (from land, labour, and capital) and includes such resources as organisational culture, knowledge, and specific competences. Competences here are seen as "distinct packages of socially complex, interconnected, tangible and intangible basic resources that fit coherently together in a synergistic manner" (Hunt, 2002, p. 25).

In conclusion, Hunt and Morgan (1996) focus in their 'Resource Advantage Theory' on comparative advantages in resources to explain the performance outcomes, noting that rewards flow to those firms that are able to successfully create new resources. Competition then is seen as "the disequilibrating, ongoing process that consists of the constant struggle among firms for a comparative advantage in resources that will yield marketplace positions of competitive advantage and, thereby, superior financial performance" (Hunt, 2002, p. 9). The general premise of the RBV is that firms which are capable to upgrade their existing resources in a path-dependent manner are suggested to be more likely to achieve superior performance (Isobe et al., 2008).

Looking at the RBV more specifically, it's not the resources itself, but rather RRs that are regarded as the key to success. Accordingly, resources and their (re)combination lead to the development of new or proprietary resource bundles, resulting in a higher degree of heterogeneity in a firm`s resource mix, which vice versa makes it more difficult for competitors to copy the firms strategy (Wemerfelt, 1984). Those unique RRs generate entrepreneurial rents, defined as "the difference between a venture's ex post value (or payment stream) and ex ante cost (or value) of the resources combined to form the venture" (Rumelt, 1987, p. 143). The concept of RR therefore contributes considerably to the RBV (Moran and Ghoshal, 1996, Rumelt, 1987).

There are also certain limitations of the RBV. First, while the RBV sees competitive advantages primarily influenced by the resources (resp. RRs) themselves, still there is ambiguity about what is defined as resources. Hodgson (2000) argues that the 'Resource Advantage Theory' is over-general in its scope and fails to distinguish between different types of resources. While supporting the argument that a firm`s portfolio of resources predominantly determines competitive advantages in resources and thus a companies` market position, Hodgson (2000) criticises the missing definition of what resources really are. He argues that the concept of resources as defined by Hunt and Morgan (1997) is too general and accordingly the theory could lose its meaning. Second, the ambiguity of how to define the resource base of a firm can also be seen as one reason for the fact that up to today little empirical research applying the RBV has been conducted (Miller and Shamsie, 1996). According to Rouse and Daellenbach (1999), the scarcity of empirical research can be traced back to the complexity that lies in identifying the core resources a firm owns and can use in order to gain a competitive advantage. Third, while the RBV argues that a firm`s portfolio of resources can mean a ‘comparative advantage in resources’, leading to a higher financial performance, the aspect of how such comparative advantages in resources can be build by firms, is not sufficiently investigated.

2.3.2.2 The Knowledge based View

The **knowledge based view (KBV)** on the firm builds upon and extends the RBV in a way that it focusses on *knowledge* as the most strategically significant resource firms possess (Decarolis and Deeds, 1999, Hawass, 2010). Accordingly, the focus of the KBV lies on knowledge, especially the way to handle data, information and knowledge as a generic resource. While the RBV recognises the role of knowledge in firms for archiving competitive advantages, researchers representing the KBV argue that, while treating knowledge as a generic resource, the RBV does not sufficiently elaborate on the specific characteristics of knowledge, and does not distinguish between different types of knowledge based capabilities. Hence, other than the RBV, the KBV views the creation, utilisation and application of knowledge as the principal rationale for a firm`s persistence (Nonaka, 1994, Spender, 1996). Following Grant`s publication (1996b) ‘Towards a Knowledge-Based View of the firm, also the organisational capability or competence can be regarded as the result of knowledge integration, whereby “the distinctiveness of a capability depends on the extent to which a firm is able to gain access to and integrate relevant knowledge residing in the minds of employees” (Hawass, 2010, p. 414).

The KBV can be lead back to the Chicago School founded by Demsetz and Stigler (1973), which focussed on studying knowledge based approaches for dealing with data, information and knowledge based on the organisational learning theory (e.g. Demsetz, 1988). Whether the KBV of the firm constitutes a theory or not, has been subject of an ongoing debate (for further reading refer to Foss, 1996, Phelan and Lewin, 2000), however, this research follows Grant`s (2002, p. 135) perception: “The emerging knowledge-based view of the firm is not a theory of the firm in any formal sense”, it rather is seen as a specific sub-category of the RBV of the firm. Nonetheless, the KBV rationale is evident in this study in a similar vein, as it is in many innovation studies, which set out to investigate new product development in firms (Danneels, 2007, Marsh and Stock, 2003, 2006, Hawass, 2010).

2.3.2.3 The Competence based View and Dynamic Capability Perspective

In contrast to the RBV (and the KBV), the **competence based view (CBV)** sees competitive advantages not solely deriving "mechanically" from the availability and quality of resources (resp. RRs), but rather from the ability to utilise these resources (Moldaschl, 2006). Underlying this view is the differentiation between resources and their use. As early considered by Edith Penrose (1959), regarded as the founder of the resource oriented research: "It`s never resources themselves that are the inputs in the production process, but only the services that the resources can render. (...) The important distinction between resources and services is not the durability; rather it lies in the fact that resources consist of a bundle of potential services and can, for the most part, be defined independently of their use, while services cannot be so defined" (Penrose, 1959, p. 25). In terms of causality, the CBV draws on a different perspective than the RBV. Researchers suggest that a firm needs to hold not only unique resources, but furthermore *specific competences* in order to transform existing resources into actual competitive advantages in the market and thus to realise competitive advantages.

A considerable boost in the strategic competence discussion and the development of an independent CBV took place in the 1990`s, with the seminal works on core competences. Short time after, there evolved a second stream of studies, which targeted a dynamisation of the core competence construct, the Dynamic Capability Perspective (DCP). The CBV constituting and most influential publications are 'The Core Competence of the Corporation' by Hamel and Prahalad (1990), the 'Competence-based Strategic Management Approach' by Sanchez and Heene (1997), and the 'Dynamic Capability Approach' by Teece et al. (1997).

With their publication 'The Core Competence of the Corporation', Prahalad and Hamel (1990) notably contributed to the development of the core competence concept. Their fundamental notion was that only those firms that hold specific basic competences, so called core competences, would be sustainable competitive in the long run. According to Hamel (1994), core competences can be defined as a bundle of combined technologies, abilities and knowledge. The latter in particular refers towards technological know-how as well as process know-how (Amponsem, 1996). Following Prahalad and Hamel (1990), core competences are not solely based on one single market or business field, they rather can be described as comprehensive competences that can be successfully implemented or adapted among different business fields. Furthermore, core competences are not the result of strategic plans, they rather develop within an emergent process (Schreyögg and Kliesch, 2003). Essential for the core competence perspective is the concentration on the conscious identification and evolution of a dominating organisational competence and their organisational-wide diffusion.

Following the core competence perspective thus it is not solely the resource base anymore, that determines a company's market position, rather the identification of valuable resources and their reallocation within resource bundles (e.g. bundles of recombined technologies, abilities and knowledge, so called core competences) are essential for competitive advantages. Hence, the core competence approach distinguishes from earlier approaches, considering for the first time the organisational know-how as a crucial competitive factor (Schreyögg and Kliesch, 2003).

Taking a more cognitive, holistic position and abstracting from core competences, Sanchez and Heence (1997) developed the 'Competence-based strategic management approach'. Their theory of competence based strategic management (CbsM) incorporates economical, organisational and behavioural concerns within a dynamic, systemic, cognitive and holistic framework (Sanchez, 2004). This theory defines competence as 'the ability to sustain the coordinated deployment of resources in ways that helps an organisation achieves its goals' (Sanchez, 2004).

However, also the (core) competence based approach has inherent limitations. First, the core competence concept implicitly proceeds on the assumption that bundles of core competences exist in every firm and just have to be identified and subsequently further developed. Second, while there are first indications of the constituting components for theses competence bundles, an explanation on how these bundles are built and combined is notably absent. Especially the aspect of the "mode of bundling", respectively the recombination of resources, would be of particular interest since here is the starting point for business relevant formation and composition. Furthermore, likewise the RBV, the core competence approach forms a relative static perspective. A concentration on once identified core competences can support a firm`s competitive position in a stable environment. Yet the assumption of stable conditions may lead to a lack of adaptability within a dynamic environment (Schreyögg and Kliesch, 2003). Firms, on the one hand, have to leverage and develop already existing resources towards stable core competences, meanwhile on the other hand they have to hinder their 'dysfunctional flip' through a permanent change, which requires a permanent replacement of resources (Leonard-Barton, 1992).

In response to this deficiency, an evolving stream of research within the competence based research, began to emerge in the late 1990`s and gained growing attention up to today, the **Dynamic Capability Perspective (DCP),** where researchers set out to incorporate a more dynamic perspective on the core competence idea, aiming to understand how firms sustain their competitive advantages in rapidly changing environments (Teece, 1997). The "Dynamic Capability Approach" published by Teece et al. (1997) is considered as the most influential publication on DCs, together with a more recent framework of DCs (Teece, 2007). With their pioneering article, Teece and colleagues (1997) argue towards a dynamisation of the competence construct, in order to address the need for a permanent advancement and adaptation of existing competences, noting the continuous environmental change and referring to the problem of obsolescence of existing competence.

Hence, essential for the DCP is the assumption that, in order to keep up with the rapidly changing environment, firms have to continuously strive to change their current asset structure and develop new technologies to address new opportunities (Karim and Mitchell, 2000, Isobe et al., 2008). Accordingly, the DCP puts the firm`s abilities to reconfigure its internal asset structure, the so called *Dynamic Capabilities (DCs)*, in the centre of interest. Following the DCP the firm`s DCs are regarded as central source of sustainable competitive advantage (Eisenhardt and Martin, 2000, Teece et al., 1997, Isobe et al., 2008). The general premise of the DCP is “that firms that reconfigure their resources faster than their rivals to capture newly emerging market opportunities are more likely to achieve superior performance” (Isobe et al., 2008, p. 414). Accordingly, scholars have emphasised the importance of “the processes to integrate, reconfigure, gain and release resources to match and even create market change” (Eisenhardt and Martin, 2000, p. 1107). In a similar vein, Teece et al. (1997, p. 516) defines the firm`s DC as “the firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments”. As such, DCs are regarded as the organisational processes and routines “by which firms achieve new resources configurations as markets emerge, collide, split, evolve and die” (Eisenhardt and Martin, 2000, p. 1107).

Hence, the DC approach - implicitly and explicitly - analyses the recombination of organisational routines and processes in regard to the continuous development of new RRs (Teece et al., 1997). An organisation`s ability or competence to continuously acquire new resources, to eliminate existing ones and moreover to reintegrate and to (re)combine them is in the centre of consideration (Eisenhardt and Martin, 2000).

Thus, in contrast to earlier works, contemporary studies within the fields of competence based research and the wider discipline of organisational learning, concentrate less on specific core competences, but rather on the development of an overall ‘organisational competence’, or DC to reconfigure its internal asset structure (e.g. Dosi et al., 2000, Schreyögg and Kliesch, 2003). Thereby, the development of the firm`s DC is not seen as an integral part, rather it is seen as a continuous development process (Montealegre, 2002). Contemporary scholars following the CBV therefore have emphasised the importance on the microfoundations of DCs (e.g. Teece, 2007, Ambrosini and Bowman, 2009), their determinants (e.g. Hawass, 2010), and perceived role for value creation in firms (e.g. Ambrosini and Bowman, 2009, Barreto, 2010, Pavlou and El Sawy, 2011).

However up to today, in most publications within the context of competence based research (including those following the DCP), competence is usually seen as an amalgam of the resource (as basis for RRs) and their selection and recombination (DCs) (e.g. Prahalad and Hamel, 1990, Turner and Crawford, 1994, Zott, 2003). In most publications within the competence based research the available organisational resources are entirely seen as part of the competence itself. Thus competence becomes a little selective construct, that in the end includes everything and thus it loses its explanation character (Schreyögg and Kliesch, 2003). Therefore differentiating between resources and DCs, allows incorporating findings from both, the resource and competence based research, and therewith offers a fruitful paths for integrative research.

Summarising the above literature review of the resource and competence based research, the following Figure 2.2 presents the development of the resource and competence based research from its early formation up to today within a histogram (based on the work by Freiling et al., 2006). The graphic shows selected milestones, which are seen as fundamental contributions to the development of the researched area. Additionally, Appendix 2.1 provides a brief overview of fundamental publications forming the resources and competence based view, their theoretical foundation and core statements. Doing so, it presents an overview of elementary theoretical bases and approaches for this research.

Figure 2.2 Selective Milestones in the Resource and Competence based Research

Source: adapted from Freiling et al. (2006)

To summarise, the review on literature from the resource and competence based research has shown, that the concept of RR and the DC approach is deeply rooted in the intersection of the resource based theory (RBV and KBV) and the competence based theory (CBV). Both theories, the resource and the competence based research, represent two major research streams in the strategy field, which complement each other and contribute to a deeper understanding of the RR concept in firms (Hawass, 2010). The first, resource (and knowledge) based perspective considers firms as a collection of different resources (Wernerfelt, 1984; Penrose, 1959, Wernerfelt, 1984, Peteraf, 1993, Barney, 1991). In this logic, the competitiveness of a firm depends basically on the control of superior resources that allows firms to outperform their competitors (Hawass, 2010). However, in order to sustain the competitive advantages in rapidly changing environments, firms must develop specific competences, DCs, in order to adapt and permanently advance the existing competences to changing market needs, and thus to realise performance potentials. This latter aspect is well addressed within the competence oriented research, which gained great attention and growing popularity in the beginning of the 21th century, and is highly recognised within the strategic management research (Schreyögg, 1999).

2.4 Conceptual Foundations: Resources, Dynamic Capabilities and Resource Recombination

Having established the theoretical foundations of the resource and competence based research, the following section provides the conceptual foundations of this research. In this section the status quo in literature is described, presenting the current knowledge of core concepts relevant for this research in order to develop a mutual understanding and deduce the central definitions for this research. Starting with the general definition of organisational resources, the following section briefly defines this research`s understanding of resources and explains the special emphasis given on knowledge based resources. Next, their social organisation within the firm will be investigated, specifically how resources are organised in firms in form of competences, capabilities, and RRs. Lastly, the management of resources will be discussed in detail, outlining the process of RR in firms, and presenting this research`s understanding of managerial competences and Dynamic Capabilities relevant for supporting this process.

2.4.1 Organisational Resources

The following section briefly outlines how organisational resources are defined and on what type of resources this research`s emphasis is placed. Generally, organisational resources are the basic unit of analysis for the resource based theory of a firm (cf. Burr and Stephan, 2006, Grant, 1991).Therefore, the availability of high qualitative resources builds the basic requirement for the development of organisational competences and competitive advantages. Accordingly, resources can be regarded as ‘the soil’ for organisational competences (Schreyögg and Kliesch, 2003).

Going back to the original definition by Barney (1991, p. 101), organisational resources in this research include “all assets, capabilities, organisational processes, firm attributes, information, knowledge, etc. controlled by the firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness”. In line with Amit and Schoemaker (1993, p. 35) firm`s resources are defined in this research “as stocks of available factors that are owned or controlled by the firm.” Notably, an important attribute of firm`s resources is that a firm does not necessarily need to own a resource or capability to be understood as part of the resource base (Helfat et al., 2007), as for example firms may have access to other resources and capabilities through alliances or networks, which would also be seen as part of the resource base. Following this understanding, resources are regarded as “something an organisation can draw upon to accomplish its aims” (Helfat et al., 2007, p. 4). Moreover, “resources are converted into final products or services by using a wide range of other firm assets and bonding mechanisms such as technology, management information systems, incentive systems, trust between management and labor, and more” (Amit and Schoemaker, 1993, p. 35). Hence, following Wiklund and Shepherd (2003, p. 1307), “resources are inputs into a firm’s production process (Barney, 1991)”.

Various different classifications of firm resources have been proposed by researchers of the resource based theory, trying to list firm`s attributes that enable firms to create value. However, up to today there is no general agreement on how the resources available in the firm can be categorised. Barney (1991, p. 101) classified the numerous firm resources into three different categories of resources, *physical capital resources* (e.g. physical technology, plants and equipment, geographical location and access to raw material), *human capital resources* (e.g. training, experience, judgement, intelligence, relationships and insights), and *organisational capital resources* (e.g. formal and informal planning, controlling, coordinating and reporting systems, informal intra- and inter-organisational relations). Grant (1991, p. 119) extended these three categories by adding another three, namely *technology* (product and process technology), *financial resources*, and *reputation* (firm`s reputation and brands). Likewise for Amit and Schoemaker (1993, p. 35) going back to Grant (1991) resources consist, inter alia, of *knowhow* that can be traded (e.g., patents and licenses), *financial and physical assets* (e.g., property, plant and equipment), and *human capital*. In contradiction to most prior classifications proposed by literature, which generally subsume the management team and its skills under ‘*human capital*’, Gutenberg (1983) explicitly defines the *management team* and *managerial capability* as an additional resource category. Similar to Gutenberg`s classification (1983), in the context of this research a differentiation between resources and capabilities is deemed valuable, as the latter decide on the input and combination of resources and therefore possesses a prominent role (Gutenberg, 1983). Hence, this research defines DCs as additional resource category and regards it as integral part of the resource base.

As a result, this research differentiates seven categories of resources that constitute a firm`s resource base: (1) *physical capital resources* (machinery, plant, equipment) (2*) human capital resource* (people), (3) *technology* (product and process technology), (4) *financial resource* (financial capital) (5) *dynamic capabilities* (organisational and strategic processes and routines) (6) *market knowledge* (market, customer, industry and competitor intelligence), and (7) *technological knowledge* (operational capabilities, organising principles, operational processes and routines, skills), as illustrated in Figure 2.3:

Figure 2.3 The Resource Base of the Firm

** Based on Galunic & Roden 1998, Teece (1997), Amit & Schoemaker (1993)*

Moreover, looking at the firms resource base and investigating the properties of resources more specifically, agreement is reached among researchers that resources can generally be distinguished into two different types of resources, those that are *knowledge based* and those that are *property based* (e.g. Miller and Shamsie, 1996, Wiklund and Shepherd, 2003, Kogut and Zander, 1992, Nonaka and Takeuchi, 1995, Conner and Prahalad, 1996, Teece et al., 1997). Thereby, literature shares a common understanding that "property based resources typically refer to tangible input resources, whereas knowledge based resources are the ways in which firms combine and transform these tangible input resources" (Wiklund and Shepherd, 2003, p. 1307).

Tangible input resources, or property based resources, in this research refer to those resources that are physical existent in the context of the organisation, e.g. machinery, plants, and equipment, buildings, production and information technologies (Schreyögg and Kliesch, 2003).

Intangible knowledge based resources, in contrast, refer to resources that are not always visible or measurable, but which are of particular importance in the process of value creation in firms (Schreyögg and Kliesch, 2003, Nonaka and Takeuchi, 1995, Galunic and Rodan, 1998). Generally, knowledge based resources refer to “the ways in which the more tangible input resources are manipulated and transformed so as to add value” (Teece et al., 1997, p. 509). Following the definition by Galunic and Rodan (1998, p. 1194), “in essence, they are the organising principles, skills, and processes that direct organisational action (cf. ‘know-how’)”.

Accordingly, in the context of this research also *capabilities* are defined as knowledge based resources and therefore are regarded as ‘resources’ in the most general sense (cf. Helfat et al., 2007, p. 4, similar refer to Barney, 1991, Ambrosini and Bowman, 2009). At this point, DCs hold a special role as they - per definition - create, modify, or extend the resource base and are part of it themselves. This would imply that they can modify and extend themselves, and indeed many instances can be found where one DC does alter another DC, e.g. Learning capacity may help to modify other DCs and operational capabilities of all types (Helfat et al., 2007). However, it also becomes evident that capabilities and other more tangible resources, should not be regarded on the same level (Schreyögg and Kliesch, 2003). Thus, in this research, even though capabilities are explicitly being defined as part of the resource base, they will be investigated separately to allow having a specific view on the role of DCs and how they are working on towards building and exploiting the resource base.

Looking at **knowledge based resources**, typically literature distinguishes between personalised and person-independent resources. Patents, contracts or licenses, operational capabilities and DCs, for example, are regarded as person-independent intangible resources, whereas individual knowledge, skills, or networks can be attributed to person-related resources (Hall, 1991, Schreyögg and Kliesch, 2003). Moreover, as generally proposed by the strategic management literature, both types of resources, *tangible input resources* and *intangible knowledge based resources* are important for value creation in firms. However, recent work in the RBV place greater emphasis on the intangible knowledge based resources, in comparison to the tangible resources (Schreyögg and Kliesch, 2003, Galunic and Rodan, 1998). This is based on the assumption that tangible resources normally can be easily acquired via strategic factor markets at the respective factor market price (e.g. Hall, 1994), while the latter does not pertain to intangible resources, which generally are more difficultly obtained, especially if they emerged within the company in an evolutionary or path-dependent way. Therefore, in many cases intangible knowledge based resources are suggested to more likely fulfil the criteria of strategic resources as defined by Barney (1991). Thus, following Wiklund and Shepherd (2003, p. 1307): “Knowledge-based resources may be particularly important for providing sustainable competitive advantage, because they are inherently difficult to imitate, thus facilitating sustainable differentiation (McEvily and Chakravarthy, 2002), play an essential role in the firm's ability to be entrepreneurial (Galunic and Eisenhardt, 1994), and improve performance (McGrath et al., 1996)".

For the above reasoning the main focus within this research is placed on the intangible knowledge based resources, without neglecting the importance of tangible resources. Moreover, looking at the knowledge based resources, special emphasis will be given to **Market Knowledge** and **Technological Knowledge**. Market and Technological Knowledge are representing the most important knowledge based resources applicable to a firm's ability to discover and exploit opportunities (Wiklund and Shepherd, 2003, Jansen et al., 2005, De Luca and Atuahene-Gima, 2007, Lichtenthaler, 2009).

2.4.2 Organisation of Resources within the Firm

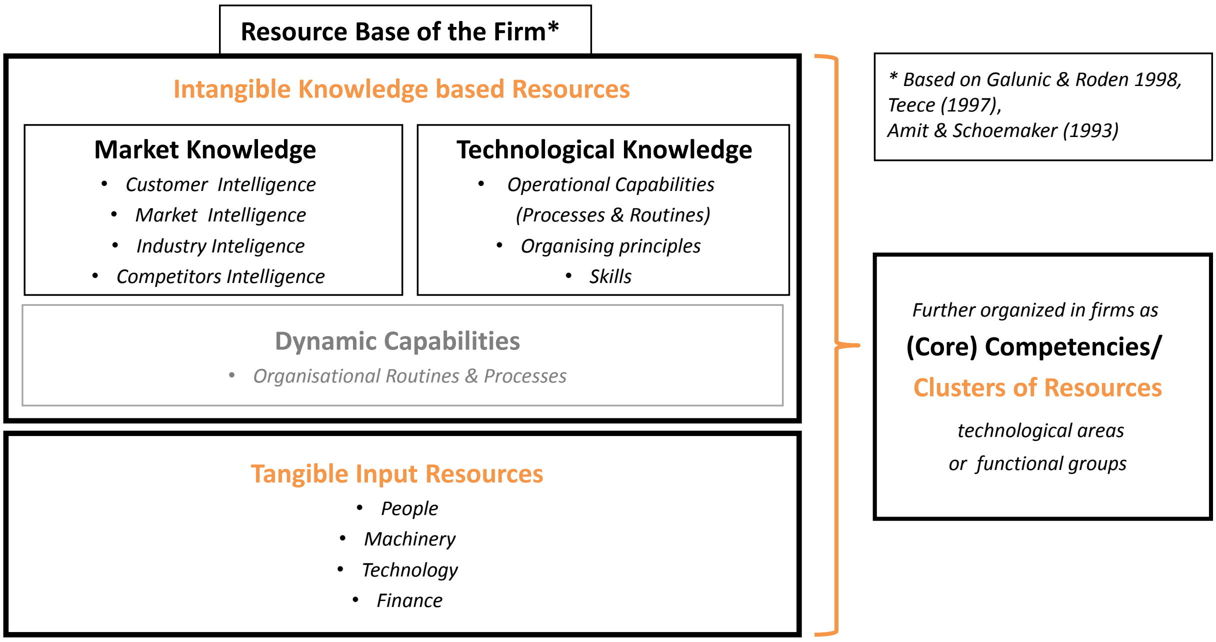
Having established the general definition of resources for this research, it is important to note that all categories of resources are of no strategic value, unless they are being effectively and efficiently organised and used within the organisation (cf. Sanchez et al., 1996, Burr and Stephan, 2006). Therefore, it is deemed valuable to have a closer look at the social organisation of resources within firms, more specifically, how the resources (intangible knowledge based resources and tangible input resources) are embedded within competence areas (clusters of resources) to form organisational competences and capabilities. Moreover, it will be subject of investigation, how the resources embedded within these competence areas may be (re)combined with other resources in new ways in order to develop new, innovative products or services or enter new markets, defined in this research as Resource Recombinations (RR).

2.4.2.1 Clusters of Resources, Organisational Competences and Capabilities

Generally, knowledge based resources along with their complementary input resources are further organised within firms in the form of **clusters of resources** (Galunic and Rodan, 1998), which basically capture the same concept as what has been referred to in literature as '*competences*' or '*capabilities*' (e.g. Galunic and Rodan, 1998, Prahalad and Hamel, 1990, Leonard-Barton, 1992, Teece et al., 1997). However, given some ambiguity over these terms (Collis, 1994), this research adapts Galunic and Rodan's understanding (1998, p. 1194) and uses the term 'competencies' to describe "combinations of input and knowledge based resources that exist at higher levels in a 'hierarchy of integration'".

Likewise, Teece et al. (1997, p. 516) define **organisational competences** as follows: "When firm-specific assets are assembled in integrated clusters spanning individuals and groups so that they enable distinctive activities to be performed, these activities constitute organisational routines and processes. Examples include quality, miniaturisation, and systems integration. Such competences are typically viable across multiple product lines, and may extend outside the firm to embrace alliance partners“. Moreover, they specify those competences which build a firm's fundamental business as **core competences** (Teece at al., 1997, p. 516). Following Teece et al. (1997, p. 516), “the degree to which a core competence is distinctive depends on how well endowed the firm is relative to its competitors, and on how difficult it is for competitors to replicate its competences”, whereby “the value of core competences can be enhanced by combination with the appropriate complementary assets”.

Figure 2.4 Organisation of Resources within Firms



Source: own illustration

Regardless of the fact that competences are much discussed in the literature, it is not yet clearly defined, what defines their boundaries (Galunic and Rodan, 1998). Referring to the example of Canon, describing their competences as fine optics, precision mechanics and electronics (Prahalad and Hamel, 1990), Galunic and Rodan (1998) point out that these competences could be further subdivided into smaller categories, for instance lens design, casting, grinding and others, which they refer to as capabilities. They further suggest that while each element is theoretically independent, these capabilities are typically grouped together into clusters of competence areas in which they are usually being applied. Therefore, capabilities are often established within “functional areas or by combining physical, human, and technological resources at the corporate level” (Amit and Schoemaker, 1993, p. 35). Correspondingly, “organizational capabilities can be built in different fields and on different levels of organizational activity, for instance at departmental, divisional, or corporate level” (Schreyögg and Kliesch, 2007, p. 915). Taking up this example, and therefore accepting that often the boundaries between competences and capabilities are unavoidably blurry (Helfat, 2011), this research adapts Galunic and Roldan’s notion (1998, p. 1194), that “at the base are the aforementioned highly specialized capabilities, [… which] are then integrated into some form of higher-order systems or clusters of resources [competences], whether technological areas (e.g., printed circuit board assembly), functional groups (e.g., manufacturing), and so on (cf. Teece et al., 1997: 516)”.

Organisational Capabilities accordingly are defined in this research as a collection of routines (Winter, 2000, 2003), which in term describe how effectively routines are executed relatively to competitors (Nelson and Winter, 1982, Pavlou and El Sawy, 2011). To point out the difference between ‘*capability*’ and ‘*capacity’*, this research adapts the statement by Helfat (2011, p. 1244) that “an organization has a specific ‘*capability*’ to imply that the organization (or its constituent parts) has the *capacity* to perform a particular activity in a reliable and at least minimally satisfactory manner”. More generally, capabilities are concerned with putting resources (and other inputs) into action (Dosi et al., 2000, Eisenhardt and Martin, 2000, Winter, 2003, Felin et al., 2012). According to Amit and Schoemaker (1993, p. 35), capabilities “refer to a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end. They are information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's resources”. As such “they can abstractly be thought of as 'intermediate goods' generated by the firm to provide enhanced productivity of its resources, as well as strategic flexibility and protection for its final product or service” (Amit and Schoemaker, 1993, p. 35).

Contrary to resources, thus, capabilities are based on processes and routines supporting the development, transfer and exchange of information through the firm`s human capital and therefore are described as ‘invisible assets’ (Amit and Schoemaker, 1993). Likewise, Felin et al. (2012) adopting Winter (2003, p. 991) refer to an organisational capability as “a high level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization’s management a set of decision options for producing significant outputs of a particular type”. Accordingly, this notion regards “learning, experience, resources, and routines as inputs to capabilities” (Felin et al., 2012, p. 5). Thus, when further looking at its microfoundations, capabilities are commonly regarded as combinations of organisational routines (Parmigiani and Howard-Greenville, 2011, Winter, 2000, 2003).

Organisational Routines are generally accepted as “repetitive, recognizable patterns of inter-dependent actions, carried out by multiple actors” (Feldman and Pentland, 2003, p. 95, Felin et al., 2012, Parmigiani and Howard-Greenville, 2011). Dosi and colleagues (2000) elaborate this perception by noting that “routines are repetitious organizational activities that, along with other resources and in combination with each other, constitute capabilities, defined as the replicable capacity to bring about an intended action” (Parmigiani and Howard-Greenville, 2011, p. 419). Therefore, capabilities and its underlying routines “enables repeated and reliable performance of an activity, in contrast to *ad hoc* activity that does not reflect practiced or patterned behaviour" (Helfat, 2011, p. 1244, similar cf. Dosi et al., 2000, Winter, 2000, 2003). Moreover, routines are proposed to be "collective rather than individual-level phenomena" (Nelson and Winter, 1982, p. 107, Felin et al., 2012, p. 5), meaning that "the emphasis is placed on the interactions rather than the individuals that are interacting" (Felin et al., 2012, p. 5). Furthermore, routines are regarded as "contextually embedded interactive processes that underpin both stability and change" (Parmigiani and Howard-Greenville, 2011, p. 423). Accordingly, they are collective and socially embedded in nature (Schreyögg and Kliesch, 2007). In consequence, this research suggests that the microfoundations of capabilities can be clustered into three general categories: (1) basic routines, (2) processes and interactions, and (3) activities.

Following Parmigiani and Howard-Greenville (2011), capabilities can further be categorised either as **Ordinary** resp. **Operational Capabilities**, which are associated with typical, day to day operations within the company, or **Dynamic Capabilities (DCs)**, regarded as those that involve creation and change (Helfat et al., 2007, Winter, 2003, Zollo and Winter, 2002). While both types of capabilities are seen as collections of routines, "dynamic capabilities describe the ability to reconfigure and change, whereas operational capabilities denote the ability to "make a daily living"" (Pavlou and El Sawy, 2011, p. 242). Other researchers propose similar schemata, differentiating between 'zero-level' resp. 'zero-order' capabilities and 'higher-level' resp. 'higher-order' capabilities (e.g. Barreto, 2010, Winter, 2003, Collis, 1994), while the former "correspond to ordinary capabilities, (…) that allow a firm to "make a living" in the short term (Winter, 2003), or to substantive capabilities, (…) used to solve a problem (Zahra et al., 2006)" (Barreto, 2010, p. 261), whereby "higher-level" capabilities, in contrast, are consistent with DCs, as they "operate to change ordinary capabilities (Winter, 2003) or substantive capabilities (Zahra et al., 2006)" (Barreto, 2010, p. 261).

Operational Capabilities, as defined in this research, relate to those capabilities "that enable a firm to make a living in the present", and thus "enables a firm to perform an activity on an on-going basis using more or less the same techniques on the same scale to support existing products and services for the same customer population" (Helfat, 2011, p. 1244, Helfat and Winter, 2011). Therefore, operational capabilities are generally regarded to help sustaining the *technical fitness* (e.g. Teece, 2007). To name some examples, following Teece (2007, p. 1345) these operational or technical capabilities (competences) may include basic ones such as order entry, billings, purchasing, financial controls, inventory controls, financial reporting, marketing, and sales.

Dynamic Capabilities, in contrast, relate to "high-level activities that link to management's ability to sense and then seize opportunities, navigate threats, and combine and reconfigure specialised and cospecialised assets to meet changing customer needs" (Teece 2007, p. 1344). Thus, DCs involves the 'capacity of an organization to purposefully create, extend or modify its resource base' (Helfat et al., 2007, p. 4), and in consequence "a firm's product or service offerings, processes for generating and/or delivering a product or service, or customer markets" (Felin et al., 2012). Accordingly, it helps to sustain the *evolutionary fitness* and thereby helps creating value for stakeholders (Teece, 2007).

There is agreement among researchers that competitive advantages can be derived from superior resources and operational capabilities, or what is referred to as *technical fitness* (Teece, 2007, Helfat and Winter, 2011). However, "if an enterprise possesses resources/competences but lacks dynamic capabilities, it has a chance to make a competitive return (and possibly even a supra-competitive return) for a short period; but it cannot sustain supra-competitive returns for the long term except due to chance" (Teece, 2007, p. 1344). Following Teece (2007), this is caused by the fact, that firms possessing resources and operational capabilities but lacking DCs will "earn a living by producing and selling the same product, on the same scale and to the same customer population" (Winter, 2003, p. 992). While those firms might be even be good at invention, they "will likely fail to capitalize on its technological accomplishments" (Teece, 2007, p. 1345), as they lack the ability to adapt their competences to changing environments.

Thus, in order to earn "Schumpeterian rents associated with 'new combinations' and subsequent recombination" (Teece, 2007, p. 1345), firms have to possess DCs. Accordingly, shedding light on "the relationships between these subsystems" (Teece, 2007, going back to Buffa, 1982, p. 2) necessitates to have a closer look on the DCs needed to sense new opportunities, and reconfigure and recombine existing assets and systems as necessary in order to achieve the *evolutionary fitness* and long run competitive success (Teece, 2007).

2.4.2.2 Resource Recombination in Firms

The output of the successful utilisation of resources, organisational competences and capabilities as described above are Resource Recombinations. In other words, "resources are converted into final products or services by using a wide range of other firm assets and bonding mechanisms such as technology, management information systems, incentive systems, trust between management and labor, and more" (Amit and Schoemaker, 1993, p. 35). Hence, the "end products are the final goods and services produced by the firm based on utilizing the competences that it possesses" (Teece, 1997, p. 516). Consequently, their competitive performance (e.g. in terms of price and quality) is dependent upon its competences, more specifically its operational capabilities and DCs.

Resource Recombination (RR) in this research refers to "how the knowledge embedded within a competence may have to be untangled, altered, and integrated with other knowledge bases to create novel business concepts and/or competencies" (Wiklund and Shepherd, 2009, p. 196, as originally defined by Galunic and Rodan, 1998, p. 1195). Therefore, this research proposes the following definition:

***Resource Recombination**, as defined in this research, describes the recombination of resources in new ways in order to develop new, innovative products or services or enter new markets.*

With the above definition, this research adapts Galunic and Roldan's (1998) and Roldan's (2002) view, that creating new products and services depends on innovation, which in turn relies on RR as the source of new ideas.

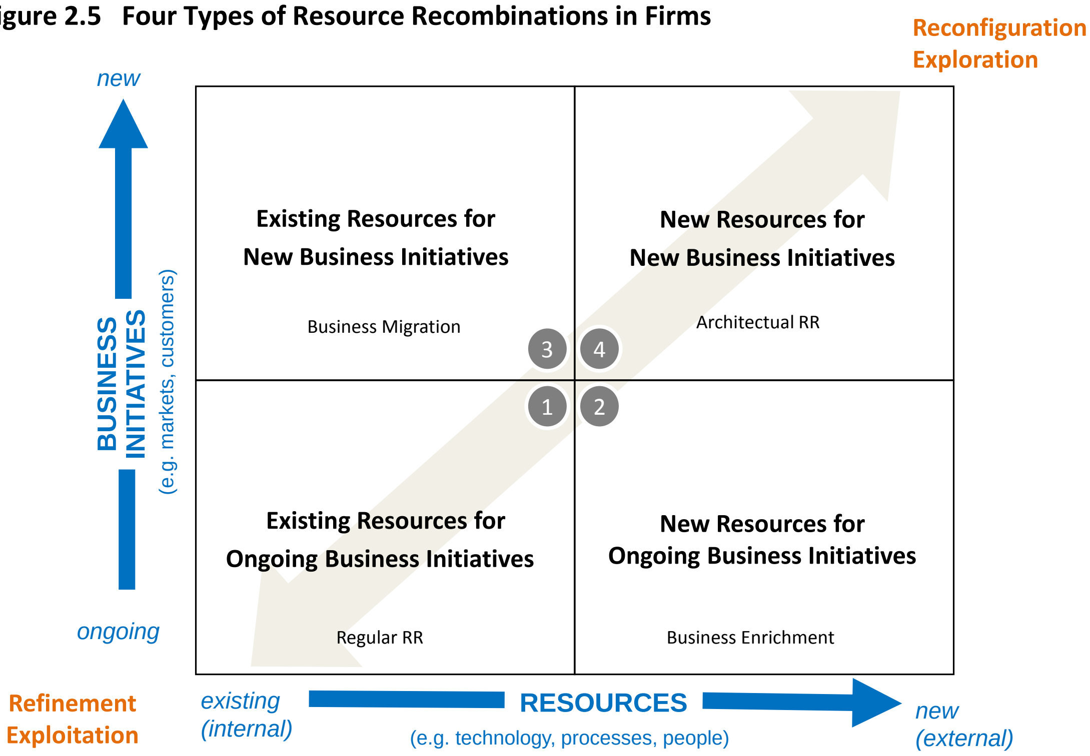
The theoretical underpinnings and perception of this research, thus, are deeply rooted in the Schumpeterian view of innovation. Schumpeter (1968) proposed that generally innovations are new combinations of existing knowledge and incremental learning (Kogut and Zander, 1992), stating that: "To produce other things, or the same things by a different method, means to combine these materials and forces differently. (…) Development in our sense is then defined by the carrying out of new combinations" (Schumpeter, 1934, p. 65f). Following Hawass (2010, p. 410), this implies that "an innovation is the product of recombining existing systems, resources and technologies in new ways", meaning that "new-to-the-world products consist of specific components that are already existing but have been creatively connected in an unprecedented manner to solve current problems" (as proposed earlier by Nelson and Winter, 1982, Galunic and Rodan, 1998). Accordingly, going back to Rumelt (1987), Schumpeter (1934) and Penrose (1959), in this research innovation is thought of "as a process of combining existing knowledge in new ways" (Rodan, 2002, p. 154) to create new, innovative products or services, whereby "this process, as it is applied to a firm's strategic resources, has been termed 'Resource Recombination'" (Rodan, 2002, p. 154). Following Lumpkin and Dess (1996) and Wiklund et al. (2002), this research only considers RRs aiming to develop new products or services or the entering of new markets as entrepreneurial.

According to Rodan (2002, p. 154) "at its heart, resource recombination depends on a cognitive process some psychologists have termed generativity", which describes "the general ability to form multipart representations from elementary canonical parts". They further describe it as a combinatorial mechanism or process of "cognitive integration" and "blending", which "although not fully understood, (…) involves the creation of a new mental space that draws on constituent elements from two completed different mental spaces", and is proposed to lie "at the heart of the creation of novelty" (Rodan, 2002, p. 154).

Although RRs can take many forms (Rumelt, 1987, Galunic and Rodan, 1998), Schumpeter (1934) proposed five principal areas, which include introducing new products or changing the qualitiy of these products, developing new production methods, finding new sources of supply, reorganising industries, and opening new markets (Zahra and Wiklund, 2002, p. 8). To further specify the notion of RR, this research adapts the typology as proposed by Zahra and Wiklund (2002) and Wiklund and

Shepherd (2009), who differentiated between **four different types of Resource Recombination** according to their usage of (i) *existing* vs. *new resources*[5] for (ii) *ongoing* vs. *new business initiatives*[6] to create new, innovative products or services (Zahra and Wiklund, 2002). Correspondingly, as presented in Figure 2.5, four different types of RR can be distinguished. These are elaborated in Appendix 2.2.

Figure 2.5 Four Types of Resource Recombinations in Firms



Source: own illustration

As noted by Galunic and Rodan (1998, p. 1195), "in either case, the realization of resource recombinations depends upon the flow of competency-related knowledge between competence areas", irrespectively of what type of RR. Knowledge flows, as defined here, refer to "the various ways in which information, know-how, understandings, histories, etc., may be exchanged in the firm regarding competencies" (Galunic and Rodan, 1998, p. 1195). The complex and versatile nature of RR

[5] The general differentiation of **existing vs. new resources** and its importance have already been extensively discussed in literature (Connor, 1999, Foster, 1986, Hamel and Prahalad, 1994, Wiklund and Shepherd, 2009). For this research's definition, *existing* resources refer to internal resources that have already been existent for a long time in/ or used by the company, while *new* resources refer to external resources that are not previously known in or used by the company, but have recently been acquired from external sources.

[6] Researchers have discussed the deployment of firm`s resources for **ongoing vs. new business activities** for a long time (Chandler, 1962, Christensen and Bower, 1996, Majumdar, 1998). *Ongoing* activities in this research are defined as those business activities, with an emphasis on *improving existing* business initiatives, such as adding new features to existing products, expanding or improving service offerings, or enhancing performance in existing business areas. *New* activities refer to business activities, were the emphasis lies on *pursuing new* business initiatives, such as entering a new market, developing (radically) new products or services for new markets, or targeting new market segments.

in firms becomes obvious as the potential use of resources and capabilities in products is various and "the couplings between different technologies, products, functions, applications, market segments and business areas are typically numerous in complex industrial organizations" (Granstrand and Söjlander, 1988, p. 40). For instance, "the development, production and use of a product usually involve several technologies and each technology can usually be applied in several products" (Granstrand and Söjlander, 1988, p. 40). Accordingly, the number of generic possibilities for new, innovative RR seems to constantly increase, as firms enlarge their stock of knowledge, get access to new technological areas, and extend their fields of knowledge through external networks and alliances. For example, it is suggested by literature that the more knowledge is collectively accumulated, the more opportunities there are for the creation of innovative new RRs (Weitzman, 1996, Moran and Ghoshal, 1999, Rodan, 2002). On the other hand, firm`s DCs may also play a major role in these processes of refinement and reconfiguration. The aim of this research therefore is to better understand the combinatorial process of RR, and those factors influencing this process.

2.4.3 Management of Resources within the Firm

After having investigated the social organisation of resources in firms - how resources are organised in firms through clusters of resources, competences and capabilities, leading to the final product of RR in firms - the following section introduces the key constructs and mechanisms concerned with the management of resources within the firm. More specifically, this section introduces the process of RR, thus how resources embedded within a competence may have to be untangled, altered, and integrated with other resources to develop new, innovative products or services or enter new markets (new RRs) (Wiklund and Shepherd, 2009, Galunic and Roden, 1998). It further discusses the managerial capabilities, respectively DCs, which are needed in order to successfully implement the process of RR. Therewith, this research distinguishes between the preconditions of RR, organisational resources, and its actual implementation mechanisms.

2.4.3.1 Process of Resource Recombination

As outlined in the previous section, Resource Recombinations (RR) in this research is defined as the recombination of resources in new ways in order to develop new, innovative products or services or enter new markets, while the process of RR is the outcome of a systematic resource selection and combination task (Schreyögg and Kliesch, 2003). It is important to note that not the cluster of resources as a whole (e.g. competences or capabilities) are the subject of the RR process, but only the single resource elements, which are important to perform a specific task. Hence, the central and often noted task of the firm is its integrating role and problem-specific selection and linking, in order to "bringing together diverse basic inputs and specialized areas of knowledge and bundling them to perform a productive task" (Galunic and Rodan, p. 1194 going back to Grant, 1996).

Except of one notable exception, the recent work presented by Sirmon and colleagues (2007), which integrated managerial processes into the theory of resource management, traditional scholars in the RBV have not "fully explored the actions firms take to create and sustain an advantage or when those actions matter most" (Holcomb et al., 2009, p. 457 f.). The resource management process described by Sirmon and colleagues (2007) outlines a comprehensive framework of the resource management processes to obtain or develop, combine, and leverage resources with the aim to create and maintain competitive advantages, and thus essentially describes, what is referred to as RR process in this research. Components of the resource management process presented by Sirmon et al. (2007) include (1) *structuring* the resource portfolio, (2) *bundling* resources to build new (operational) capabilities, and (3) *leveraging* those capabilities in order to implement new, innovative products or services (RRs) in the market and thereby to provide value to customers, gain a competitive advantage, and create wealth for owners.

The first resource management process step, **structuring** the resource portfolio, refers to the management of the firm`s resource portfolio (Sirmon et al., 2007). It comprises specific sub-processes such as *acquiring* (Barney, 1986, Makadok, 2001), *accumulating* (Dierickx and Cool, 1989, Garud and Nayyar, 1994), and *divesting* (Leonard-Barton, 1992), in order to obtain those resources applicable for being used in the subsequent bundling and leveraging resource management stages (see Sirmon et al., 2007, p. 278 ff.). Thereby, *acquiring* refers to purchasing resources from strategic factor markets (Sirmon et al. 2007, p. 278 going back to Barney, 1986), *accumulating* refers to the internal development of resources, which becomes necessary as strategic factor markets are unlikely to provide all resources required (Sirmon et al., 2007, p. 279), and *divesting* refers to the process of shedding firm-controlled resources, necessary for generating the slack and flexibility needed to acquire new resources of higher value (Sirmon et al., 2007, p. 280). However, while structuring the resource portfolio is regarded as an important resource management process step, as the resource portfolio provides the basis for developing new capabilities, and thus new RRs, "this process alone is insufficient to create value for customers and owners" (Sirmon et al., 2007, p. 281).

The second resource management process step, **bundling** resources, refers to combining firm resources to create new operational capabilities (Sirmon et al., 2007) in order to implement new, innovative products or services (RRs) in the market. Bundling involves three different subprocesses, namely *stabilising* (Siggelkow, 2002)*, enriching* (Puranam et al., 2003), and *pioneering* (March, 1991). These processes are applied to integrate resources to alter or construct new capabilities for the purpose of developing new innovative products or services (RRs), with "each capability being a unique combination of resources allowing the firm to take specific actions, that are intended to create value for customers" (Sirmon et al., 2007, p. 281). *Stabilising* thereby refers to making "minor incremental improvements to existing capabilities" (Sirmon et al., p. 281). *Enriching* refers to extending and elaborating current capabilities, e.g. by adding complementary resources from the resource base to a current resource bundle (cf. Sirmon et al. 2007, p. 281). *Pioneering* relates to creating new capabilities to address new market opportunities, e.g. by integrating completely new resources, recently acquired from strategic factor markets, and adding them to the existing portfolio to create new resource bundles (cf. Sirmon et al., 2007, p. 282). Accordingly, "while the pioneering bundling process may include the recombination of existing resources, it often involves the integration of new resources with existing ones to create new capabilities" (Sirmon et al. 2007, p. 282). Generally speaking, while structuring is an important step that helps to manage the resource portfolio, "bundling resources into new capabilities is a necessary step in appropriating the potential value embedded in the firm's resource portfolio" (Sirmon et al., p. 281).

The third resource management process step, **leveraging** capabilities, refers to the application of firm`s capabilities in order to implement new, innovative products or services (RRs) in the market to create value for the customer and wealth for owner (Simon et al., 2007). It contains a set of subprocesses such as *mobilising* (Hamel and Prahalad, 1994), *coordinating* (Alvarez and Barney, 2002), and *deploying* (Teece, 2007) used to exploit capabilities to address opportunities in the market (see Sirmon et al., 2007, p. 283 ff.). Thereby, *mobilising* refers to identifying the capabilities needed to develop the RRs (e.g. capability configurations, innovative products or services) necessary to exploit opportunities in the market (cf. Sirmon et al., 2007, p. 284), *coordinating* refers to integrating the identified capabilities into effective yet efficient RRs (cf. Sirmon et al., 2007, p. 285), and *deploying* refers to physically using the new resource configurations to support a chosen leveraging strategy. Hence, "the ability of the firm's [operational] capabilities to create value for customers is realised through their successful deployment" (Sirmon et al., 2007, p. 285) in form of new innovative RRs. Summarising, effective leveraging is an important process step because "even when a firm owns or controls resources and has effectively bundled them to develop capabilities with value-creating potential, the firm is unlikely to realise value creation unless it effectively leverages/uses those capabilities in the marketplace" (Sirmon et al., 2007, p. 283).

Notably, while each individual component of the RR process is important to optimise resource value creation in firms, the single resource management steps must be synchronised (Sirmon et al., 2007, 2010). Following Sirmon and colleagues (2007, p. 287), "creating synchronization requires top-level managers to be simultaneously involved in all stages of the resource management process while consistently scanning the external environment for salient cues about important change". Thus, an effective implementation of the RR process steps, as described above, requires firms to possess the necessary competences and capabilities to be able to effectively structure the resource portfolio, to bundle resources to create new capabilities, and to leverage them effectively in the market.

The explication of the RR processes steps in this section gave important insights in explaining, how resources can be managed to create value for the customers and owners. However, it is not defined yet, what capabilities and competences are needed to implement these processes.

2.4.3.2 From Managerial Competences to Dynamic Capabilities

It revealed, that the single RR process steps are closely linked to what has been referred to in the literature as '**Managerial Competence**' or '**Managerial Ability**' (e.g. Kraaijenbrink et al., 2010, Sirmon et al., 2010). Research findings reveal multiple reasons to expect that a superior managerial ability to understand and effectively use firm resources would imply higher RR sucess. Thus, to deploy the RR process steps as described above allows firms to exploit the untapped value of their resources, for the following reasoning (Holcomb et al., 2009): First, superior knowledge about the resources is generally proposed to allow managers to be more effective than competitors at the selection and acquisition of new resources at a favourable price by revealing their 'real' value for future use (Makadok, 2003). An explanation may be, that for managers, which have a more precise understanding of the resource value for future activities, it is easier to discover and exploit factor market imperfections (Amit and Schoemaker, 1993, Denrell et al., 2003, Holcomb et al., 2009). Second, managers having superior knowledge of the firm and competitive context are found to be more effective than competitors in adapting strategies that create value for the customers by bundling and leveraging resources in new ways, which allows to exploit the value creation potential of those resources (e.g. Hansen et al., 2004, Lippman and Rumelt, 2003, Holcomb et al., 2009).

For that reason, research finding on resource management reveal that managerial actions determine in large parts the realised value of resources (Sirmon et al., 2007, 2010). It is not surprising that, as firms differ in their ability to manage their resources, the value they extract through RRs varies significantly (Holcomb et al., 2009). Accordingly, in their recent work Wiklund and Sheperd (2009) stressed the crucial importance of RR activities for the effectiveness of alliances and acquisitions, stating that "resource combination activities constitute a broad construct including the acquisition, development, accumulation and usage of resource" and subsequently, that "the greater the capability for conducting such activities, the better firms will be at discovering and exploiting the value of alliances and acquisitions." Following the argument by Wiklund and Shepherd (2009), a sole focus on the value creation potential of resources, as well as on single resource management steps, only provides an incomplete understanding of performance implications for the development of new RRs, unless researchers are looking at the *capabilities of the firm* to recombine these resources.

Consequently, building on the insights of the resource management process as proposed by Sirmon et al. (2007) and translating the single steps of the RR process into firm`s capabilities, this research argues that the firm`s capability to manage its resources and to bundle them into new RRs, as well as to leverage them on the market, is a critical capability that is necessary to extract the potential value residing in a firm's resource portfolio.

Still, past research from the RBV predominantly concentrated on the managerial competence, referring to the manager`s ability to effectively manage the firm`s resources (e.g. Sirmon et al., 2010). Barney (1991) for example reasoned that a manager`s ability to understand and effectively use the firm`s resources, can be regarded as a valuable resource itself, which "has the potential for generating sustained competitive advantages" (Barney, 1991, p. 117). In a most recent attempt, also Holcomb and colleagues (2009) explicated the joint role of manager's ability and resource quality for value creation.

However, demarcating from past research stressing the importance of manager's ability to understand and effectively use firm resources, this research sets out to investigate the firm`s capacity on a meta-level. More specifically, this research suggests that the firm`s ability to effectively reconfigure its resources is not to be attributed to specific characteristics of individuals, but can be established at an organisational level. Doing so, this research builds on established insights from the DCP and expands the argumentation by Wiklund and Sheperd (2009) and Sirmon et al. (2007) by abstracting from the observed RR processes and activities to a higher-order DC of the firms to recombine its resources. Thereby, it is not solely looking at the RR processes, nor the managerial ability to handle these processes, but moreover sets out to investigate the underlying organisational processes and routines established at an organisational level that build the microfoundations of a firm`s DC. Correspondingly, this research argues that the greater the DCs of the firm relevant for conducting RR activities, the better firms will be at discovering and exploiting the value of their resource base. The following section specifies the notion of DCs for this research.

2.4.3.3 Dynamic Capabilities

The growing body of literature investigating the topic of **Dynamic Capabilities (DCs)** yield to a number of distinct but related definitions of the construct (e.g., Teece et al., 1997, Eisenhardt and Martin, 2000, Zollo and Winter, 2002, Winter, 2003, Zahra et al., 2006, Helfat et al., 2007, Teece, 2007). More recently, with the aim to provide an overview and consolidation of past research, Barreto (2010) reviewed 40 articles on DC in the leading management journals between 1997 and 2007, and found nine different definitions of the concept. As noted by Barreto (2010, p. 257): "such a proliferation of definitions shows the dynamism generated by the topic and is justified by the youth of the approach, but it also produces some confusion that may hinder more effective progress within the field". Accordingly, "despite (or perhaps due to) the large number of theory papers published recently, consistent terminology remains elusive" (Parmigiani and Howard-Greenville, 2011, p.446).

Since Teece and colleagues' (1997) original contribution, which also builds the principal definition of DC for this research, a variety of authors have contributed own definitions of the concept, however most of them can be traced back to the original definition by Teece et al. (1997), or are adaptations of it (Ambrosini and Bowman, 2009). The most influential definitions are provided in the Table 2.2:

Table 2.2 Main Definitions of Dynamic Capabilities (Source: based on Barreto, 2010)

Overviewing these definitions shows that from a general viewpoint, consensus is reached among researchers concerning the principal character of the DC construct. However, at some points (e.g. concerning its locus of change, or its environmental context) also contradictory views exist about the concept (Ambrosini and Bowman, 2009), as will be further discussed in the following.

First, regarding the **nature of the concept,** DCs have been defined as *abilities* or *capacities* (capabilities) (e.g., Helfat et al., 2007, Teece, 2000, 2007, Winter, 2003, Zahra et al., 2006), but also as *processes* or *routines* (e.g. Eisenhardt and Martin, 2000, Zollo and Winter, 2002) (for a more detailed analysis, see Barreto, 2010, p. 260). However, given some ambiguity over these terms, they are generally used to describe similar even interchangeable concepts at a different level of granularity, as detailed in chapter 2.4.2.1. Hence, this research uses the following conceptualisation of DCs:

(1) *DCs* refer to the firm`s *capacities* or *abilities* “to deploy resources, usually in combination, using organizational processes, to effect a desired end” (Amit and Schoemaker, 1993, p. 35). At the same time these capacities are constituted by organizational *processes* and *routines*.

(2) *Routines*, which are “repetitive patterns of interdependent organizational actions” (Parmigiani and Howard-Greenville, 2011, p. 417), build the microfoundations of Dynamic Capabilities (Dosi et al., 2008, Parmigiani and Howard-Greenville, 2011).

(3) Thereby individuals, their skills, and complex processes and activities build the foundation of routines (Parmigiani and Howard-Greenville, 2011).

Second, concerning the **specific role of DCs,** from the above definitions it emerges that the literature is consistent in admitting the central role of DCs in changing the key internal components of the firm. However, the chosen ‘locus of change’, which describes the specific internal components that are changed, exposes to vary across components such as the *resource base* (e.g., Eisenhardt and Martin, 2000, Helfat et al., 2007, Teece, 2007, Augier and Teece, 2007, Ambrosini and Bowman, 2009, Barreto, 2010) and *capabilities* or *competences* (e.g. Teece et al., 1997, Winter, 2003), operating *routines* (e.g. Zollo and Winter, 2002), and *resources* and *routines* (Zahra et al., 2006) (for a more detailed analysis see Barreto, 2010, p. 261). However, all different attempts correspond in the central perception that they “referred to the concept as a capacity (Helfat et al., 2007) or as the routines (Eisenhardt & Martin, 2000) by which an organization alters its resource base” (Barreto, 2010, p. 261). Bringing it down to a common denominator this research subsumes:

(4) The locus of change where the firm`s DCs are working on, is to build and exploit the firm`s *resource base.*

While consensus is reached among researchers that the specific role of DCs is to change the resource base, it is not yet clearly defined, how this role is constituted. Therefore, the investigation of how the specific DCs act upon the resource base by building and exploiting it, and how both constructs are linked with the organisational outcome of new RRs, lies in the core of this research. The aim is to bring clarity to the notion of DCs, and their role and effects towards developing RRs in firms.

Third, concerning the **environmental context** relevant for DCs, different views can be found among researchers (refer to Barreto, 2010, p. 261 f.), varying between (1) those attempts that unequivocally attribute the concept to highly *dynamic, volatile,* and *rapidly changing environments* (e.g., Teece et al., 1997, Teece, 2007), (2) those attempts that acknowledge its relevance in highly but *also* in *moderately dynamic environments*, where "change occurs frequently, but along predictable and linear paths" (e.g., Eisenhardt and Martin, 2000, p. 1110) and therefore accept different degrees of environments (e.g., Eisenhardt and Martin, 2000), (3) those attempts proposing that "a volatile or changing environment is not a necessary component of a dynamic capability" (Zahra et al., 2006, p. 922) and thus attribute it to both *stable* and *dynamic environments* (e.g., Zahra et al., 2006, Zollo and Winter, 2002, Helfat et al., 2007), and lastly (4) those attempts that do not explicate the external environmental conditions as relevant, thus implicitly assuming the irrelevance of such conditions for their arguments (e.g., Makadok, 2001). Consistent with this view, this research adapts Zahra and colleagues' (2006) and Zollo and Winter`s (2002) argumentation, assuming that:

(5) DCs exist and are also used in environmental contexts characterised by low rates of change. However, at the same time this research suggests, that they may be of higher relevance and value in dynamic markets.

Fourth, concerning the **creation and development mechanisms of DC**, the above definitions show a consistent claim in literature concerning the perceived role of learning mechanisms in the creation and development of DCs (Barreto, 2010). Consistent with literature this research defines:

DCs are regarded as evolutionary organisational learning mechanisms, as such they are:

(6) *path dependent* (Zollo and Winter, 2002),

(7) *built* rather than bought in the market (Makadok, 2001),

(8) *firm specific* and as such embedded in the firm (Eisenhardt and Martin 2000), and

(9) *evolving* over time (Ambrosini and Bowman, 2009).

(10) *learned* and stable pattern of *collective* activity (Zollo and Winter, 2002)

These definitions also delineate what DCs are not. Firstly, they are not ad hoc problem-solving events or spontaneous reaction (Winter, 2003, Helfat et al., 2007, Schreyögg and Kliesch, 2007), hence they must be repeatable or contain some patterned element (Dosi et al., 2000, Winter, 2002, Winter, 2003, Zollo and Helfat, 2011), and secondly, the definitions by Zahra et al. (2006) and Helfat et al. (2007) clearly show that luck does not constitute a DC (Ambrosini and Bowman, 2009).

Fifth, concerning the relationship between DCs and its **performance outcomes,** generally two different types of approaches can be found among the above definitions (cf. Barreto, 2010, p. 274): The first type of approaches assumes a *direct relationship* between DCs and their performance outcomes or competitive advantages (e.g., Teece et al., 1997, Zollo and Winter, 2002), suggesting that DCs are "the sources of enterprise-level competitive advantage over time" (Teece, 2007, p. 1320). In contrast, the second type of approaches reasoned an *indirect relationship* between DCs and performance, presuming that DCs do not necessarily lead to higher performance or competitive advantage (e.g., Eisenhardt and Martin, 2000, Zott, 2003, Helfat et al., 2007), rather that the respective "performance effects may depend on the characteristics of the resulting new resource configuration or on how managers use their dynamic capabilities" (Barreto, 2010, p. 263). For example, Eisenhardt and Martin (2000, p. 1106) argue that "dynamic capabilities are necessary, but not sufficient, conditions for competitive advantage", suggesting that sustainable competitive advantages would not rely on DCs themselves but on the quality of resource configurations (resp. RRs) created by the DCs, e.g. by "using dynamic capabilities sooner, more astutely, more fortuitously than the competition" (Eisenhardt and Martin, 2000, p. 1117). Likewise, Zott (2003) reasoned that DCs are not directly linked to performance outcomes, but in fact are proposed to indirectly influence firm performance through modifying resources bundles (RRs) or routines. Correspondingly, Zahra et al. (2006) postulates the relationship between DCs and performance to be indirectly moderated by the quality of substantive capabilities modified by DCs. Other authors see the proposed causal link between DCs and performance outcomes predominantly determined (mediated) by the availability of the resources on which the DCs act upon (Makadok, 2001). In line with the argument by Barreto (2010) this research subsumes, that the second type of approaches, suggesting an indirect relationship between DCs and performance outcomes, may describe the most promising. Therefore:

(11) DCs are suggested to act on towards changing the resource base.

(12) The availability of high quality resources and the deployment of DCs may influence the development of new, innovative resources combinations RRs, which in turn may affect performance outcomes.

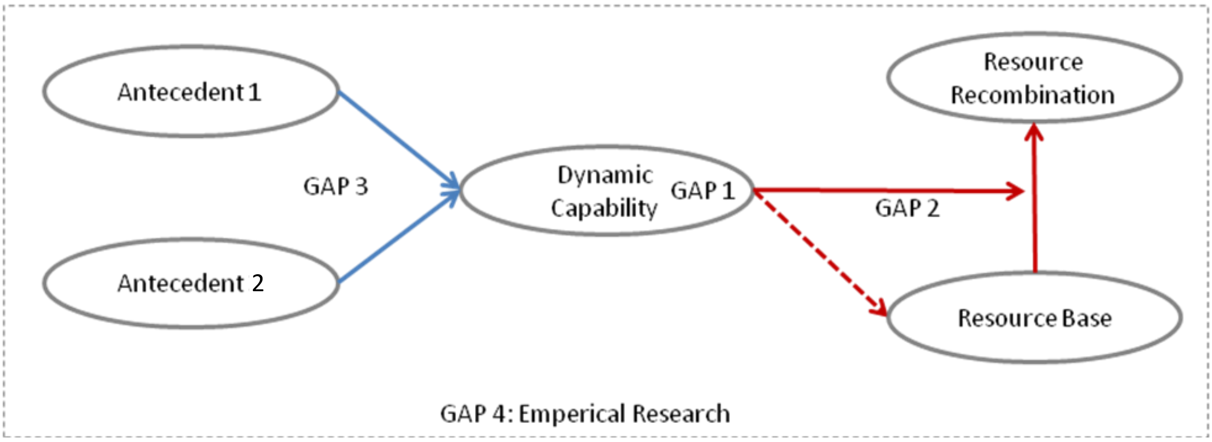
(13) Therefore an *indirect relationship* between DCs and performance outcomes is suggested.

This perception is also consistent with earlier proposals in this field, that presumed DCs as a key antecedent of firm`s success and failure, strategic choices and competitive advantage (Teece et al., 1997). However, maybe due to the strong focus initially put on the direct relationship towards performance, up to today those propositions remained mainly unexplored (Barreto, 2010). In recent years, researchers started to conceptually and empirically address the impact of DCs on intermediate outcomes (e.g. Pavlou and El Sawy, 2011), as well as their effect on performance (e.g. Isobe et al., 2008). However, following the call by Barreto (2010, p.275f) "future research should continue to explore these relationships between DCs and intermediate outcomes, on one hand, and between intermediate outcomes and performance, on the other hand, to better assess which dynamic capabilities and intermediate outcomes deserve more attention".

2.5 Research Gaps derived from the Literature Review

There is a discussion of identified gaps in the literature in Appendix 2.3, but the key areas affecting this research are outlined below. In summary, the review of current literature has shown that there is an urgent need for a coherent theory and model of resource value creation in firms through RR. Accordingly, a strong need exists, to examine the DCs relevant for RR to occur (GAP 1), to investigate their role and effect in building and exploiting the resource base for building new RRs (GAP2), and furthermore to investigate the organisational- and interorganisational framework conditions influencing the development of a firm`s DCs (GAP 3) within qualitative and quantitative research setting (GAP4). In addition, this research sets out towards incorporating the insights from both the RBV and the DC perspective and applying them to the concept of RR. With the aim to present an integrated picture, this research attempts to weave these streams together, from a conceptual and empirical angle. The following Figure 2.6 shows the knowledge gaps elaborated above, which will be addressed within this PhD work.

Figure 2.6 Research Gaps in the existing RBV and DC Literature (Source: own illustration)



GAP 1: There still is a poor understanding of the construct of DC and a lack of a measurable model of a specific set of DCs, which makes it difficult to approach.
GAP 2: The influence of the firm`s DC on the successful development of RR – specifically its role and effect in building and exploiting the resource base – has not yet been extensively investigated, neither has it been measured empirically.
GAP 3: Far too little attention has been paid to an empirical investigation of the influencing factors for the development of DC on a firm- and network-level.
GAP 4: Empirical research on the relationships between the resource base, DCs and RR is still lacking.

2.6 Chapter Summary

The primary contribution of this chapter was to provide the theoretical and conceptual foundation for this research, embedding the concept of Resource Recombination (RR) and Dynamic Capabilities (DCs) within the wider discipline of strategic management and entrepreneurship, identifying existing knowledge gaps and introducing the core concepts and definitions relevant for the further investigation of this research.

As shown in chapter 2.2 both strategic management and entrepreneurship researchers share a common and strong interest in value and wealth creation through RRs. Researchers from both disciplines, the strategic management and the entrepreneurship spectrum, have recognised the high relevance of RR for innovation generation and the crucial importance of RRs as a means of creating wealth. It has been shown that RR constitutes an important topic, where different scientific disciplines intersect and where fruitful integrative research can be carried out. Recognising the value of RRs for future wealth creation, there is a current shift in literature from investigating the importance of RRs towards an investigation of how RRs can be fostered. The focus of contemporary research within this research field furthermore goes apart from the investigation of the resources a firm owns (as suggested by the RBV) towards an investigation of how these resources can be used in new, rent regarding ways and subsequently, what competences are needed in order to successfully implement RRs in the strategic management (referring to the CBV).

Chapter 2.3 further established the theoretical foundation of this research, investigating the resource and competence based research, which could be identified as the principal parent theories of this research. After presenting the evolution and background of both these streams, the resource based view (RBV), the competence based view (CBV), and the knowledge based view (KBV) were further described as relevant streams this research is contributing to.

In chapter 2.4 the conceptual foundations of this research could be further established. Based on the status quo in literature, core concepts relevant for this research were defined in order to develop a mutual understanding and deduce the central definitions for this research. Starting with the general introduction of what is meant by organisational resources within this research, its social organisation within firms was delineated, and finally the RR process as well as managerial capabilities and DCs relevant for the management of those resources were discussed. The section closed with a critical review of definitions for the DC construct, leading to a common understanding of the concept as defined for this research.

Finally, chapter 2.5 presented the research gaps addressed in this research. Based on the though review of existing literature, the research gaps identified in the literature were outlines and further discussed.

Deriving from the literature review presented in this chapter, several implications for this research can be deduced, summarised in the following working assumptions:

First, Resource Recombinations (RR) will be defined as the recombination of resources in new ways in order to develop new, innovative products or services or enter new markets, while the process of RR is the outcome of a systematic resource selection and combination task, which is substantially influenced by the firm`s DCs.

Second, based on the review of resource and competence based research, this research differentiates between ‘Resources’ and ‘Dynamic Capabilities’, referred to as the firm`s ability to manage, renew and recombine the resource base in new ways to develop new innovative products and services (RRs). With the differentiation between ‘Resources’ and ‘Dynamic Capabilities’, this approach demarcates from most publications within the context of competence based research, where usually organisational competence is seen as an amalgam of the resource (as raw material for RRs) and their selection and recombination (represented by its DCs) (e.g. Prahalad and Hamel 1990, Turner and Crawford 1994, Zott 2003, Schreyögg and Kliesch, 2003). Thus, in most publications within the competence based research, the available organisational resources are entirely seen as part of the organisational competence itself, the consequence being that competence becomes a little selective construct, that in the end includes everything and thus it loses its explanatory character (Schreyögg and Kliesch, 2003).

Third, the fundamental requirements for the development of RRs are (i) the availability of valuable resources and (ii) the firm`s DC, regarded as the firm`s ability to manage, renew and recombine the resource base in new ways. Resources thus are seen as the “raw material” or “building blocks” for the RRs. They are considered as the “soil”, without those RR and in turn competitive advantages cannot be derived (Schreyögg and Kliesch, 2003). However, the focus of this research lies on the DC, respectively the intersection between the resource base and the DC in archiving RRs. Hence, the examination of construct of DC, its characteristics and influencing factors, will be the central subject of investigation within this research, as the DC defined as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece, 1997, p.516) is suggested to determine the situational, organisational selection and combination of organisational resources.

For the above reasoning, this research assumes that a substantial proportion of variance in resources productivity across firms can be explained by the differences attributed to the firm`s DCs for the selection and recombination of resources. The availability of (high quality) resources in contrast is rather seen as a precondition for the development of RRs. Further specifying these preliminary assumptions the following chapter presents a detailed discussion of the conceptual model.

Chapter 3: Development of the Conceptual Model and Hypotheses

3.1 Introduction

To provide a basis for the conceptual development and empirical investigation of RR in firms from a DC point of view, this chapter outlines the theoretical framework, the determinants and framework conditions of the RR concept and outlines the research`s arguments and related hypotheses. By investigating the relation between the resource base, DCs, and its performance outcomes RR, this chapter contributes to establish a better understanding of these interrelations, leading to the development of a conceptual model to be tested, refined, and validated in a following qualitative and subsequent quantitative research step. Doing so, this research addresses some existing shortcomings in the DC literature, where there is a crucial need to better understand the interrelationship between DCs, the resource base of the firm, and innovation in the form of RRs. The aim is to bring clarity to the notion of DCs, their role and effects towards RRs in firms. Hence, with the conceptual model presented in this chapter, a more precise understanding of the firm`s DCs will be given, shedding light on their role and effects towards developing new RRs in firms. Doing so, this chapter opens up the black box of RR in firms and offers strategic pathways on how firms can strategically foster recombination of existing resources as an important source for continuous innovation generation.

The conceptual model presented within this chapter is based on a comprehensive literature review in the fields of resources and competence based research, drawing on existing theories from the entrepreneurship and strategic management spectrum. Reviewing and aligning current theories as well as existing empirical studies in the wider field of RR, this research develops a conceptual model for RRs in firms.

First, this chapter begins with an examination of resource value creation in firms, integrating the RBV and DC perspective to form the model`s theoretical base. With the differentiation of potential and realised value of resources, the preliminary considerations of this research are outlined.

Second, based on these preliminary considerations, the following section investigates the potential value of the resources base of the firm for RR, comprising the introduction of a set of characteristics of resources suggested as relevant for determining the potential value of the resource base, namely *resource diversity, resource quality, resource complementarity, resource transferability, resource deployment flexibility,* and *resource renewal*. The discussion is followed by a presentation of theoretical linkages between these selected characteristics of the resource base and RR, culminating in a subset of the study's hypotheses.

Third, the subsequent section elaborates on the DCs of the firm, presenting the *Dynamic Capability Framework* and investigating the role of DCs in the process of RR. The DC framework builds the conceptual foundation of the firm`s DCs, introducing the four DCs relevant for the process of RR, namely *Sensing Capacity, Learning Capacity, Integrating Capacity* and *Coordinating Capacity*, describing their underlying activities, processes and routines, and outlining their general relation towards RR with the aim to provide a general understanding of the construct of DC. Based on the DC framework and the conceptualisation of the four DCs, their role in the process of resource value creation is further elaborated and hypotheses are derived clarifying their role and effects towards building RR.

Fourth, the subsequent section investigates the framework conditions for the development of the four DCs. Investigating the effect of the firm`s strategic orientation on the development of a firm`s DCs, specifically its *Networking Orientation* and *Entrepreneurial Orientation*, the aim is to elaborate the extent to which the firm`s strategic orientation (directed towards internal and external entities) influences the development of DCs and thus RRs. Also this section closes with a subset of hypotheses to be tested in this research.

Aligning the research findings, the last section outlines the conceptual model and summarises the studies` hypotheses to be further analysed in the subsequent qualitative and quantitative research steps.

3.2 Preliminary Considerations: Resource Value Creation through Resource Recombination

The following discussion refers to a large degree to Linnemann (2012) due to a thorough discussion of the conceptual foundation and framework in this article.

3.2.1 Potential and Realised Value of the Resources

Scholars from both the resource based and competence based tradition often ask ‘how value is created in firms’ and ‘what it is that explains the competitive heterogeneity and variance in value creation across firms’. According to the RBV, the competitiveness of a firm can be primarily lead back to its access to resources that are valuable, rare, inimitable and non-substitutable (VRIN) (e.g., Barney, 1991), while the CBV sees the competitive advantages rather influenced by a firm`s ability to utilise these resources by devising and implementing strategies to extract the value potential of resources (e.g. Moldaschl, 2006). Consequently, when studying the concept of RR in firms, an investigation of resource value creation in firms is deemed valuable.

Looking at resource value creation in firms, literature generally distinguishes between the ‘**potential value**’ and the ‘**realised value**’ of resources (e.g. Madhok and Tallman, 1998). Applied to the concept of RR in firms, this research differentiates between the potential value of resources *for* RR and the realised value generated *through* new RRs.

The **potential value of resources <u>for</u> RR** describes the value of resources a firm possesses for their use in new, synergetic RRs, and therefore is also referred to as the *value creation potential* of resources. The value creation potential is determined by the quality and diversity of the resources itself in such a way that the resource portfolio establishes the upper bounds of the firm`s value creation potential (Makadok, 2003) and thus builds the basis for value creation in firms (Sirmon et al., 2007, Holcomb et al., 2009, Barney, 1991). In the context of this research, the resources thus can be regarded as the “raw material” for the development of new RRs, and the more valuable resources are the higher their value creation potential of those resources is suggested to be. This is in line with the RBV`s perception of value creation in firms.

However, under the premises that a ‘strategic factor market’, as defined by Barney (1986) exist, “where firms buy and sell the resources necessary to implement their strategies” (p. 1232), and thus assuming that all required resources or assets can be bought and sold for a given price, in such markets, following Barney (1986, p. 1231) “the cost of acquiring strategic resources will approximately be equal to the economic value of those resources”. In consequence, presuming “the absence of imperfections in [those] strategic factor markets, buyers will not be able to extract superior economic performance from any factor” (Diericks and Cool, 1989, p. 1504). In other words, the value of any resource would on average equal the factor market price, and yet no value would be created simply through owing resources.

Accordingly, scholars following the resource based tradition often ask “what it is about resources that give them inherent potential for value creation” (Holcomb at al. 2009, p. 461), aiming to identify important characteristics of resources that allow to explain differences in resource productivity and value creation performance (e.g. Peteraf, 1993, Peteraf and Barney, 2003). It is suggested that the value creation potential of the resource base is influenced by certain characteristics of the resources (contextual or contingency factors) that determine its utility for RR (e.g. Noteboom et al., 2006, Birkinshaw et al., 2002).

However, solely possessing or having access to high valuable resources does not guarantee that the value creation potential of those resources becomes realised and new value is created (Barney and Arikan, 2001, Priem and Butler, 2001, Sirmon and Hitt, 2009). Therefore, extending the focus of the RBV, scholars following the CBV have added “that while owning or having access to valuable and rare resources is necessary for competitive advantage, they must be effectively managed and synchronised to *realise* a competitive advantage” (Holcomb et al., 2009, p. 457, going back to Hansen et al., 2004, Kor and Mahoney, 2005). Accordingly, possessing valuable, rare, in-imitable and non-substitutable (VRIN) resources (Barney, 1986) is regarded as a necessary but insufficient condition for resource value creation (Sirmon et al., 2007). De facto, value is rather created when resources are evaluated, manipulated and deployed in new, synergetic RRs (Lippman and Rumelt, 2003, Sirmon et al., 2007). Moreover, research highlights that the synergetic use of existing and new resources can lead to a higher total (realised) value than the use of resources independently from each other (Chi, 1994, Hitt et al., 1991, Larsson and Finkelstein, 1999, Madhok and Tallmann, 1998).

Indeed, as important as the investigation of the resources, and how specific characteristics of the resources determine the value creation potential, is it to explore the extent to which firms exploit that potential (Holcomb et al., 2009). Less research, however, investigates that question, and even though, most RBV scholars agree that "what a firm does with its resources is as important as which resources it possesses" (Holcomb et al., 2009, p. 461), the RBV is often criticised for underestimating the question of resource utilisation. Barney and Arikan (2001, p. 174) for example state that the "resource based theory has a very simple view about how resources are connected to the strategies the firm pursues". Subsequently, more research is required as "the processes by which firms obtain or develop, combine, and leverage resources to create and maintain competitive advantages are not well understood" (Sirmon et al., 2007, p. 274).

The **realised value of resources <u>through</u> RR,** also termed *value realisation,* refers to the total value created in firms through the efficient usage of resources in form of new, innovative RRs. According to Holcomb at al. (2009, p. 461), an indicator for the realised value created from resources is the "level of resource productivity", which they describe as the net benefits achieved from resource management through successful RR activities. In this research, RR is regarded as an indicator for the realised value of resources, seen as net benefits achieved from resource management, through the "firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments" (Teece, 1997). New, synergetic RRs are a proxy for measuring the performance outcome of the firm`s DCs through efficiently managing resources.

Accordingly, differences in value realisation performance across firms can either be attributed to resources possessing different levels of latent (e.g. unrealised) efficiency, thus referring to the potential value of resources for RR, or the firm's usage of the available resources in different ways (Holcomb et al. 2009). This reflects Penrose`s (1959, p. 25) early notion that "the services yielded by resources are a function of the way in which they are used—exactly the same resource when used for different purposes or in different ways and in combination with different types or amounts of other resources provides a different service or set of services". Following this perception of value creation in firms, the realised value increases when firms produce greater utility with the same inputs (resp. the same utility with fewer inputs) through effective management and redeployment of resources in superior RRs (Peteraf and Barney, 2003, Bowman and Ambrosini, 2000, Holcomb et al. 2009). This is based on the assumption that most often it is not the individual resources that are proposed to be VRIN, rather more it is the unique, in-imitable and non-substitutable combinations of those resources, the RRs that give them inherent value. However, given that the process of RR involves uncertainty and great parts of the realised value are observed as being serendipitous and unforeseen a priori (Graebner, 2004), the total value created is often not recognised until the resources have been bundled (Denrell et al., 2003, Moran and Ghoshal, 1999, Wiklund and Shepherd, 2009)[7].

These reasoning suggests, that firms - in order to realise the total value creation potential of their resources - should foster the ability to combine their resources in predictable and in novel ways to create both expected and serendipitous value. The findings further imply that firms with superior DCs to manage their resources, can realise a performance advantage (Adner and Helfat, 2003, Sirmon et al., 2007, Teece, 2007). It reveals that achieving synergetic RRs is not simply a matter of adding high quality and complementary resource to the existing resource portfolio (Wiklund and Shepherd, 2009). Over time, the set of resources the firm possesses must be altered and the way they are bundled must be changed if the competitive advantage of the firm is to be sustained (Barney, 1991, Black and Boal, 1994, Capron et al., 1998). Thus, in order to untangle the value creation potential these resources must be effectively managed. To realise the value creation, firms must accumulate, combine and exploit its resources (Grant, 1991, Sirmon and Hitt, 2003).

To summarise, when speaking of the potential value of resources in this research, it comprises (only) the *value creation potential* of the resources *for* the development of new, synergetic RRs, while the *realised value* is the actual measurable value of those new generated RRs. The potential value of resources is related to resource acquisition and exploration, while the realised value of resources refers to combination activities and exploitation (Denrell et al., 2003, Penrose, 1959, Zahra and George, 2002, Wiklund and Shepherd, 2009). Hence, for this research it is important to look at both, the resources a firm possess, which determine the *potential value for RR*, as well as the DCs of the firm that influence the *realised value through* building new, synergetic *RRs.*

[7] For this reasoning, the realised value of resources can be further differentiated in *expected* and *serendipitous value*, whereby the former refers to resource benefits that were predictable a priori (e.g. at the time of the acquisition), while the later refers to value creation that was not anticipated a priori but rather emerged from opportunities to discover new paths to create value (Graeber, 2004). Investigating value creation within technological mergers and acquisitions, Graebner (2004) revealed that the most successful acquisitions involved the creation of such serendipitous value, and moreover, that firms varied significantly in their ability to realise appropriate serendipitous value. On the downside, firms are found to enforce constraints as "many value-creating resource combinations fail to occur because managers have neither the ability to recognize the opportunity nor the means to exploit it" (Holcomb et al., 2009, p. 461), resulting in considerable differences that exist among firms in their ability to realise value from the resources they possess (Holcomb et al., 2009).

3.2.2 Resource Endowments and Dynamic Capabilities

Comprising the conceptual considerations about resource value creation in firms as outlined above, and integrating the RBV and DC perspective, the following chapter further specifies the model`s theoretical base, delineating the three core propositions for this study.

The RBV suggests that a firm`s resource base can be regarded as a set of resources (e.g. technologies, knowledge, competences, skills) that is available at one point in time. In the context of this research, the resource base is seen as the "raw material" or "building blocks" for the development of new RRs. Hence, the resource portfolio establishes the upper bounds of the firm`s **value creation potential** (Makadok, 2003). Accordingly, the resource base builds the basis for value creation through new RRs (Sirmon et al., 2007). At the same time it is assumed that the extent to which the firm`s resources determine the potential value of the resource base for RR depends on certain **characteristics of the resource base**, that might influence the value creation potential of the resources for RR. Thus it is suggested that certain characteristics of the resources forming each resource bundle may have a measurable effect on the realised value through RR. Accordingly, investigating RR in firms needs to take into account the nature of the firm`s knowledge base (e.g., Birkinshaw et al., 2002, Germain and Dröge, 1997). Together, these arguments suggest that the value creation potential of the resource base for RR is influenced by certain characteristics of resources, its resource endowments. In other words, it is the resource endowments that determine the **potential value** of resources for RR. Hence, it is suggested that the more valuable the resources the higher their potential value for RR and thus, the higher the likelihood of new RRs in firms. This leads us to our first proposition:

Proposition 1: A high valuable resource base is positively associated with RR in firms. The <u>potential value of the resource base</u> for RR thereby is influenced by certain characteristics of the resources.

On the other hand, as the preliminary considerations have shown, solely possessing or having access to resources that are valuable, however, does not guarantee that the value creation potential becomes realised and new value is created through new RRs (Barney and Arikan, 2001, Priem and Butler, 2001, Sirmon and Hitt, 2009). Likewise in dynamic environments, the availability of high valuable resources alone does not guarantee a competitive advantage over time. Indeed, in dynamic environments the resources and the way they are bundled have to be changed. As stated by Lippman and Rumelt (2003, p. 1085) "the heart of business management and strategy concerns the creation, evaluation, manipulation, administration, and deployment of unpriced specialized resource combinations". Thus, value is realised only when the resources available are recombined and managed appropriately to the environmental context (Sirmon et al., 2007). Research findings further revealed that the synergetic use of existing and new resources, can lead to a higher total, realised value than the use of the resources independently from each other (Chi, 1994, Hitt et al. 1991, Larsson and Finkelstein, 1999, Madhok and Tallmann, 1998). Accordingly to stay competitive in dynamic environments firms have to develop DCs to manage, renew and recombine the resource base (the “raw material”) in new ways to develop new innovative products and services (RRs).

This research assumes that firms differ in their DCs to manage and recombine their resources in ways that enhance performance. Accordingly, the extent to which the value potential of the resource base becomes *realised* (in form of new innovative RRs) depends on the ability of the firm to integrate and coordinate those resources in order to discover and conduct new RRs. Thus, this research postulates that the firm`s DCs to manage resources and to bundle them into new RRs is a critical capability that is necessary to extract the potential value residing in a firm’s resource portfolio, and transform it into a **realised value**. Hence, firms that have developed higher DCs are more likely to build and exploit the potential value of their resource base, and therefore are more likely to successfully develop new RRs. This means, that owing the “right” resource brings limited benefits to firms unless deliberate effort is devoted towards developing the DCs necessary for resource combination. Thus, DCs help both creating and realising value by enhancing resource productivity through efficient usage of resources, leading to the second proposition:

Proposition 2: A firm`s overall DC is positively associated with the amount of RRs in firms due to both <u>building</u> and <u>exploiting</u> the potential value of the resources base.

Finally, this research postulates that the firm`s strategic orientation, specifically its Entrepreneurial Orientation and Networking Orientation, play a major role in developing DCs in firms. The underlying assumption is, that while DCs reside in the organisational processes and routines, they are regarded to being impacted by the organisational framework conditions (at firm- and network-level) that the organisation has created to manage it business activities (Teece 2007). Current literature shows growing interest in investigating the antecedents that are suggested to influence the development of DCs (e.g. Madsen 2010, Hawass, 2010). While a wide range of different antecedents residing at individual-, firm- and network-levels have been proposed in the literature (Rothaermel and Hess, 2007) and discussed as relevant determinants for the development of DCs (e.g. Teece, 2007, Zollo and Winter, 2002, Eisenhardt and Martin, 2000), this research is focussing on firm- and network-level antecedents, leading to the third proposition:

Proposition 3: Entrepreneurial Orientation and Networking Orientation act as antecedents for the development of a firm`s DCs.

Summarising the above findings, when investigating RR in firms – it would be insufficient only to look at certain characteristics of the resource base and how they are influencing the development of RRs in firms. Instead, the aim is to look at the DCs in relation to the resource base, especially how the DCs are working towards building and exploiting the resource base, and what the framework conditions are for the development of such capabilities in firms.

Assuming that firm`s resources vary in their potential to create value (depending on certain characteristics of those resources, as e.g. quality and diversity) and that firms vary in their DCs to build and extract this value creation potential and transfer it into a realised value, this research makes a contribution towards exploring how the two phenomena work together. By explicitly embedding the DC perspective in resource based explanations for value creation, the aim is to specify the **joint role of firm`s DCs** and the **resources endowments** in conjunctly achieving **new RR** by building and exploiting the potential value of resources.

3.3 The Potential Value of the Resource Base and Resource Recombination

The following section starts with a specification of the above Proposition 1 in order to specify the interrelationship between the potential value of the resource base and RR in firms, while controlling for the influence of specific characteristics of the resource base on its potential value. The aim is to better understand how **specific characteristics of the resource base** influence the **potential value of the resources for RR**.

Proposition 1: A high valuable resource base is positively associated with RR in firms. The potential value of the resource base for RR thereby is influenced by certain characteristics of the resources.

While scholars following the resource based tradition often ask "what it is about resources that give them inherent potential for value creation" (Holcomb at al. 2009, p. 461), aiming to identify important characteristics of resources that allow to explain differences in resource productivity and value creation performance (e.g. Peteraf, 1993, Peteraf and Barney, 2003), little research has empirically measured their influence on RR in firms. Hence, further research is required to clarify the influence of specific characteristics of the resource base for value creation in firms.

Literature suggests that the firm`s existing resource base plays an essential role in the process of resource value creation (Cohen and Levinthal, 1990, Isobe et al., 2008). The notion underlying this perception is that the firm`s future recombinant innovation depends on the existing resource base, essentially saying that the amount and level of the firm`s current resources are the primarily prerequisite to the successful reconfiguration of these resources (Isobe, 2008). This is in line with the view that firm`s assets evolve in a path dependent manner (Teece et al., 1997).

As outlined in chapter 2.4.1 this research focusses on the firm`s knowledge based resources, specifically its Market Knowledge und Technology Knowledge, as both are referred to in literature as representing important knowledge based resources applicable to a firm's ability to discover and exploit opportunities (Wiklund and Shepherd, 2003, Jansen et al., 2005, De Luca and Atuahene-Gima, 2007, Lichtenthaler, 2009). **Market Knowledge** refers to the firm's understanding of the market environment, particularly of customers and competitors (e.g. De Luca and Atuahene-Gima, 2007), while **Technological Knowledge** refers to the firm`s technological expertise, R&D as well as engineering skills and competences (e.g. De Luca and Atuahene-Gima, 2007). Technological and Market Knowledge complement each other, and their availability likely enhances innovation and performance (Lane et al., 2006, Song et al., 2005). Dierickx and Cool (1989) emphasised that the amount and level of the firm's knowledge based resources are the primary determinants defining the firms asset position. Generally, when investigating the value creation potential of the resource base, literature predominantly refers to *resource quality* (e.g. Holcomb et al., 2009) and *diversity* (e.g. Granstrand and Sjölander, 1990, Peteraf, 1993) as important determinants for the value creation potential of the firm`s resource base. Thus, the potential value of the resource base in this study is, in the first place, determined to the availability and quality of Market and Technological Knowledge.

There is a consistent claim in literature that a high degree of **Technological Knowledge** is positively associated with RR in firms. Firm`s having a high degree of Technological Knowledge have developed an advanced understanding of technologies, products and processes, R&D expertise and skills. Thus, Technological Knowledge can foster the firm`s ability to effectively address market opportunities by providing the necessary technological skills, e.g. for developing an optimal design of products or for redesigning technical processes to optimise functionality, costs, and reliability (Rosenberg, 1994, Wiklund and Shepherd, 2003). Hence, a high degree of Technological Knowledge is proposed to advance firm`s innovation performance (Zahra et al., 2000). This implies that the potential value of the resource base for RRs will predominantly depend on the amount and quality of Technological Knowledge the firm possess. Accordingly, this research suggests the following hypothesis:

H1: *Technological Knowledge has a direct, positive effect on RR.*

Likewise Technological Knowledge, **Market Knowledge** is proposed to positively affect RR in firms. A high degree of Market Knowledge provides firms with information about the market, specifically about customers and competitors, is a source for stimulating the firm`s Technological Knowledge (Day, 1994, Nonaka, 1994) and is a driver for high market and customer orientation (De Luca and Atuahene-Gima, 2007). Following De Luca and Atuahene-Gima (2007, p. 97), "a firm that correctly identifies, collects, and uses information about customer and competitor conditions is deemed to be knowledgeable about the market". Therefore, it is proposed to be positively associated with RR in firms. Literature commonly agrees that a high degree of Market Knowledge (in terms of breadth and depth) is positively associated with RR in firms. However the relationship will only be indirectly through Technological Knowledge. This is based on the argument by Lichtenthaler (2009, p. 823), who argues that the role of Market Knowledge is to provide "a firm with insights into the functions that Technological Knowledge may fulfil", thus the "technological knowledge is the knowledge that a firm actually explores, transforms, and exploits" through its RR activities. Accordingly, this research suggests the following hypothesis:

H1(1): *Market Knowledge has an indirect, positive effect on RR, through Technological Knowledge.*

Based on these more general assumptions that both Market and Technological Knowledge are proposed to have a positive effect on RR in firms, the following sections sets out to elaborate **specific characteristics of knowledge based resources** that might have an influence on value creation potential of the resource base for RR. Based on an extensive review of existing RBV literature, six characteristics of the Market and Technological Resources could be derived, and are proposed as relevant characteristics for determining the potential value of the resources for RR, these are namely: (1) **resource diversity** (e.g. Granstand and Sjölander, 1988, 1990, Galunic and Rodan, 1998, De Luca and Atuahene-Gima, 2007), (2) **resource quality** (e.g. Zahra et al., 2000, De Luca and Atuahene-Gima, 2007, Wiklund and Shepherd, 2003), (3) **resource complementarity** (e.g. Wiklund and Shepherd, 2009, Chi, 1994, Hitt et al., 1991, Larsson and Finkelstein, 1999, Madhok and Tallmann, 1998), (4) **resource transferability** (e.g. Nonaka, 1994, Galunic and Rodan, 1998, Szulanski, 1996), **(**5) **resource deployment flexibility** (e.g. Sanchez, 1995, Sanchez, 2004, 1995; Holcomb et al., 2009; Sanchez and Mahoney, 1996), and (6) **resource renewal** (e.g. Connor, 1999, Foster, 1986, Hamel and Prahalad, 1994, Wiklund and Shepherd, 2009). In the following sections each characteristic will be discussed and elaborated in detail and hypotheses will be derived.

Doing so, this research contributes to an enhanced understanding of value creation in firms by addressing how specific characteristics of the knowledge based resources may influence a firm`s ability to recognise and exploit the resources through building new RRs (Lane et al., 2006). The aim is to provide further insights by investigating where heterogeneity of resource positions comes from and how the characteristics of knowledge based resources influence the firm`s innovation performance (Noteboom, 2003). Doing so, this research addresses existing shortcomings in the RBV literature, where there is a lack of empirical evidence on the influence of knowledge characteristics on the firm`s ability to utilise it for new RRs (Lane et al., 2006). This is especially relevant as "the majority of studies fail to adequately explain the underlying factors driving performance differences across firms" (Noteboom et al., 2003, p. 2). Next, we explore the effect of resource diversity on resource value creation.

3.3.1 Resources Diversity: Market and Technological Knowledge Breadth

Resource Diversity in this research is addressed by means of **Market and Technological Knowledge Breadth**, which refers to the number or range of different knowledge areas the firm is familiar with (De Luca and Atuahene-Gima, 2007, Bierly and Chakrabarti, 1996). This is in line with Prabhu et al. (2005, p. 116) referring to knowledge breadth as “the range of fields over which the firm has knowledge”. Following De Luca and Atuahene-Gima (2007), thereby **Market Knowledge Breadth** refers “to the firm’s understanding of a wide range of diverse customer and competitor types and factors that describe them”. Accordingly, a firm is regarded to possess a high Market Knowledge breadth if it holds broad knowledge of current and potential customers and competitors and uses a variety of parameters to describe and evaluate them (Zahra et al., 2000, De Luca and Atuahene-Gima, 2007). Consistently, **Technological Knowledge Breadth** refers to the firms understanding of a wide variety of knowledge and expertise in various technical areas and different technological environments, thus it denotes the range of areas in which a venture learns new technological skills (Teece et al., 1994, Zahra et al. 2000).

There is a consistent claim in the literature that firms with a broad knowledge base have a greater potential to recombine different elements of that knowledge and thus generate more possibilities for new RRs by improving opportunity recognition and creative potential (Kogut and Zander 1992, Reed and DeFillippi, 1990, Granstand and Sjölander, 1988, 1990, Galunic and Rodan, 1998, De Luca and Atuahene-Gima, 2007). Thus, Market and Technological Knowledge breadth positively affect the potential value of the resource base for RR. Accordingly, in recent literature increasing consensus is reached that resource diversity or heterogeneity provide a significant potential for knowledge creation and innovation because it yields opportunities for novel combinations of complementary resources (Noteboom et al., 2006). Viewed differently, reducing the heterogeneity of activities taking place in the organisation will reduce the variety of knowledge held in the organisation and thus lowers the potential for new combinations (Galunic and Rodan, 1998). Accordingly, drawing on existing theory in innovation, creativity and knowledge management, a predominant view is that broad Market Knowledge is suggested to enhance product innovation by means of increasing the firm`s ability to draw linkages among disparate market information, ideas, and concepts to develop new perspectives (Reed and DeFillippi, 1990). While in a similar vein broad Technological Knowledge suggested to positively affect innovation performance as it provides access to diverse technological areas that can be used to design and offer a greater variety of innovative products (Zahra et al., 2000). Related arguments are put forward in organisational learning theory, admitting knowledge diversity to have a positive effect on learning and innovation, as it provides a robust basis for assimilating new and related knowledge based on what is already known, and moreover facilitates the innovative process by enabling novel connections and linkages to be made (Cohen and Levinthal, 1990). Also empirical evidence to these findings is given, Van Wijk et al. (2001) for instance confirm that breadth and depth of knowledge is positively associated with a firm's propensity to explore new and related knowledge (Zahra and George, 2001). This view is supplemented by research findings looking at ideation processes within firms, showing that groups possessing a larger knowledge base formed by different knowledge areas are shown to develop better innovations than homogenous groups (Björk and Magnusson, 2008). This is corresponding to Nonaka (1994) who argues that one prerequisite for knowledge creation and innovation is resource diversity (Björk and Magnusson, 2008).

However, also a number of articles exist in the innovation literature contrasting this view, stating that too much heterogeneity may also negatively affect RR in firms. For example Wiklund et al. (2002, p. 5) propose that "the accumulation of too many resources may restrict the searching for new innovative resource recombination". Thus, it is suggested by several authors that a too high knowledge breadth might hinder recombination activities as a high degree of diversity of knowledge leads to an enhanced complexity of knowledge transfer across functional units caused by communication difficulties, misunderstandings and unproductive conflicts (e.g. Galunic and Rodan 1998, De Luca and Atuahene-Gima, 2007, Tushman and Romanelli, 1996, Teece et al. 1997, Björk and Magnusson, 2008). This is especially true as broad Market and Technological knowledge may require regular and numerous changes, which further enhance the complexity of knowledge transfer. As a consequence, increased difficulties in transferring and sharing broad knowledge requires firm`s to develop necessary capacities for integrating and coordinating diverse resources in order to discover and conduct new RRs (De Luca and Atuahene-Gima, 2007, Bhidé, 2000).

Summarising the above arguments, the discussion has shown that the diversity of knowledge based resources, specifically the Market and Technological Knowledge breath, plays an important role for building the potential value of the resource base for RR. Consistent with these research findings, this research generally suggests a positive relation between Market and Technological Knowledge breadth and RR in firms, proposing that the more diverse the resource base, the more possibilities for RR exists and thus the higher the amount of RRs in firms. However, this relationship is suggested to be influences by the firm`s Integrating and Coordinating capacities (refer to chapter 3.4.2.2.), in a way that the broader the Market and Technological Knowledge, the greater the use of knowledge integration and coordination mechanisms (De Luca and Atuahene-Gima, 2007). This leads to the following hypothesis:

H1a *(Resource Diversity): A high Market and Technological Knowledge breadth is positively associated to RR in firms.*

3.3.2 Resource Quality: Market and Technological Knowledge Depth

Resource Quality in this research is addressed by means of **Market and Technological Knowledge Depth**, which is defined in this study as the level of sophistication and complexity of the firm`s knowledge in a specific area (De Luca and Atuahene-Gima, 2007), referring to the depth and quality of learning (Zahra et al., 2000). Thus, while Market and Technological Knowledge breadth denotes the horizontal dimension of knowledge, knowledge depth captures its vertical dimension (De Luca and Atuahene-Gima, 2007). Thereby, following Prabhu and colleagues (2005), **Technological Knowledge Depth** captures "the amount of within-field knowledge the firm possesses" (De Luca and Atuahene-Gima, 2007, p. 98) and refers to the quality and complexity of knowledge in technical areas and understanding of its different, interdependent and unique elements (McEvily and Chakravarthy, 2002). Whereas **Market Knowledge Depth** on the other hand refers to the level of sophistication and quality of the firms knowledge of its customers and competitors, comprising in-depth understanding about the interdependencies of customer needs, behaviours, and desires, as well as competitor`s products and strategies (De Luca and Atuahene-Gima, 2007).

Likewise knowledge breadth, the depth of knowledge is regarded as essential determinant influencing the potential value of the resource base for RR. In recent years, consensus is reached among researchers, that deep Market and Technological Knowledge is positively associated with innovation performance (e.g. Zahra et al., 2000, De Luca and Atuahene-Gima, 2007, Wiklund and Shepherd, 2003). The literature claims, that firms possessing a thorough understanding and deep expertise of markets and technologies will have a higher potential to efficiently combine different elements of that knowledge and in consequence come up with new innovations (De Luca and Atuahene-Gima, 2007). Thus, Market and Technological Knowledge depth is proposed to positively affect the potential value of the resource base for RR. Vice versa, it can be assumed that firms, which are exposed to hold Market and Technological Knowledge only at an elementary or basic level and have not yet learned or mastered to develop new skills, indicated by a low depth or quality of learning, will have a reduced quality of stock of knowledge available for RR (De Luca and Atuahene-Gima, 2007), and therefore are proposed to have an inferior position for developing new, innovative RRs. More specifically, Market Knowledge depth is suggested to positively affect innovation performance as it foster`s the firm`s ability to adapt its products and services to changing market needs, capitalise on market dynamics and identify emerging technological changes, that may influence firm performance (Zahra et al., 2000). In a similar vein, Technological Knowledge depth is proposed to advance firms innovation performance (Zahra et al., 2000) by fostering the firm`s ability to address market opportunities, for instance by redesigning its products for ease of use, optimising functionality, cost or reliability (Rosenberg, 1994). In consequence, a high quality of available resources, captured by the firm`s Market and Technological Knowledge depth, can be seen as a necessary precondition for developing new RRs.

There are also publications, however, stating that deep knowledge may also cause problems for recombination (e.g. Galunic and Rodan, 1998). As deep Market and Technological Knowledge implicate complex interdependences among the different elements of knowledge (McEvily and Chakravarthy, 2002), the transfer of deep knowledge comprises a high risk of misconception and misapplication in new RRs (Galunic and Rodan, 1998, De Luca and Atuahene-Gima, 2007). Therefore, knowledge depth may bound the firm`s rationale for drawing new conclusions and finding new linkages among different elements of knowledge (De Luca and Atuahene-Gima, 2007). Moreover, by means of comprising expertise in different functional areas, deep knowledge may also lead to "strong local identities" and different "thought worlds" (Leonard-Barton, 1992, Dougherty, 1992), which is suggested to further hamper the ease of knowledge transfer, as it hinders the firm`s ability to assimilate new knowledge from other functional areas (Szulanski, 1996, De Luca and Atuahene-Gima, 2007). This is due to the fact that "as the stock of within-competence knowledge and meaning grows, and becomes more complex relative to the stock of knowledge about other competencies, people's absorptive capacity for within-competence knowledge will rise compared to their intercompetence absorptive capacity (Cohen and Levinthal, 1990)" (Galunic and Rodan, 1998, p. 1199). Therefore according to Galunic and Rodan (1998), the social and institutional packaging of firm's knowledge will also impact RR in firms.

Summarising the above arguments, this research generally suggests that deep Market and Technological Knowledge positively affect the potential value of the resources for RR. However, as outlined above, the availability of deep Market and Technological Knowledge alone does not automatically lead to realised value of the resources, indicated by the amount of RR (McGrath et al., 1995, Zahra et al., 2003). For deep Market and Technological Knowledge to yield a competitive advantage, it must be captured, integrated, and deployed effectively (Grant, 1991, 1996). Therefore it is proposed that the deeper the within-competence knowledge the greater the use of knowledge integration and coordination mechanisms (De Luca and Atuahene-Gima, 2007). Accordingly, the relationship between Market and Technological Knowledge depth and RR in firms is suggested to be influenced by firm`s Integrating and Coordinating capacities (refer to chapter 3.4.2.2.).

***H1b** (Resource Quality): A high Market and Technological Knowledge depth is positively associated to RR in firms.*

3.3.3 Resource Complementarity: Knowledge Complementarity

Resource Complementarity refers to the level to which different areas of knowledge available to the firm complement each other, and is captured in this research by means of **complementarity of Market and Technological Knowledge**. Complementarity in this context refers to firm`s resources that are complementary to each other, meaning that they can be effectively combined with other resources the firm possess (Hitt et al., 2001, Song et al., 2005). Moreover it can be contradistinguished from supplementary resources, which describe resources that serve the same functions than other resources (Wernerfelt, 1984, Song et al., 2005). To illustrate this, when a firm has a strong R&D capabilities for example, it may easily detect the potential for research based synergy by acquiring another firm with similar (supplementary) resource strengths through pursuing economies of scale and scope, or increased market power (Ansoff, 1965, Montgomery, 1985). However if the same firm acquires a firm with weaker R&D capabilities, yet strong (complementary) market-related capabilities (e.g. strong marketing and distribution capabilities), the potential synergy from the combination of those complementary resources may lead to a higher total value and competitive advantage, as it is more likely to realise serendipitous value, which is difficult for competitors to detect and to assess a priori (Harrison et al., 2001). Hence, integrating different, yet complementary Market and Technological Knowledge opens new opportunities for synergetic RRs (Song et al. 2005), reduces the resource deficiency, and generates new applications of those resources (Kogut and Zander, 1992, Teece et al., 1997).

Resource complementarity, thus, is proposed as a relevant determinant that may influence the potential value of the resource base for RR. Support for this assumption emerges predominantly from research investigating resource value creation in alliances and acquisitions, where recent research findings point towards complementarity of resources, rather than its similarity as proposed by earlier works (e.g. Kusewitt, 1985, Singh and Montgomery, 1987), creates the potential for higher synergy among resources, and therefore would lead to a higher long-term firm performance (Harrison et al., 1991, Harrison et al., 2001). Hence, it is suggested that valuable, unique, and inimitable, synergetic RRs are more likely to be realised by integrating complementary resources. This is especially relevant in the light of research findings following the RBV, giving evidence that the synergetic and complementary use of existing and new resources can lead to a higher total, realised value than the use of the resources independently from each other (Chi, 1994, Hitt et al. 1991, Larsson and Finkelstein, 1999, Madhok and Tallmann, 1998). Consistent with the general perceptions of the RBV, Wiklund and Shepherd (2009) argue that the potential value of the resource base would increase when the resources acquired are complementary to the existing ones. Accordingly, a high complementarity of resources is suggested to lead to a higher value creation potential of resources for RR. For the difficulties in measurement, however, empirical evidence is still scare, and only few studies exist that could empirically confirmed the proposed relation. A notable exception is the work by Song and colleagues (2005), who could empirically verify the positive effect of the complementarity of market and technological resources on firm performance.

Based on the above arguments, this research assumes a positive effect of *resource complementarity* on RR, in a way that the higher the complementarity of the Market and Technological Knowledge within the resource base, the higher the amount of RRs in firms. However, at the same time it has to be noted, that the existence of complementary resources is regarded as necessary, yet insufficient condition for realising synergetic RRs, as following Harrison (2001, p. 679) “the resources must be effectively integrated and managed to realise the synergy”. In consequence, the positive effect is proposed to be enhanced with higher integrating and coordinating mechanisms.

H1c *(Resource Complementarity): Complementary Market and Technological Knowledge is positively related to RR in firms.*

3.3.4 Resource Transferability: Knowledge Tacitness

Resource Transferability refers to the degree to which resources within the firm can easily be transferred and articulated across disciplines. It is regarded as relevant resources characteristic that might influence the potential value of the resource base for RR, as recombination is based on competence-related knowledge flows (Galunic and Rodan, 1998) and existing and new knowledge may not always be easily understood, replicated and transferred to new contexts (Leonard-Barton, 1995, Szulanski, 1996). Resource transferability was captured in this research by means of **Knowledge Tacitness,** which describes “the extent to which market knowledge is not explicit but rather is difficult to codify and communicate” (De Luca and Atuahene-Gima, 2007, p. 98), prostrating that a high tacitness of knowledge is negatively related to its observability, and thus transferability. Knowledge is described as tacit, when people perceive difficulties in making explicit what they know, thus when “the knowledge consists of implicit and non-codifiable skills or ‘know-how’” (Lane et al., 2006, 846). This underlies the assumption, that knowledge, which does not become explicit, cannot easily be leveraged by the organisation as a whole (Nonaka, 1991), as tacit knowledge can only be transferred from one individual to another through a complex process of articulation and apprenticeship (Galunic and Rodan, 1998, Szulanski, 1996, Nonaka, 1991).

Literature commonly agrees that “tacitness slows the internal transfer of (market) knowledge because tacit knowledge cannot be fully codified and articulated even by an expert” (De Luca and Atuahene-Gima, 2007). Generally the effectiveness of knowledge codification as a common method for making knowledge accessible across disciplines will more decrease, the greater the tacit component of knowledge (Galunic and Rodan, 1998). In consequence, following the argument by

Galunic and Rodan (1998), this research suggests that the likelihood of RR will be diminished, the higher the tacitness of the knowledge base, both due to both lower detection probability and higher costs of resource exchange. Reasons supporting this assumption are the following: First, the detection probability for new, valuable RRs will be reduced, the more tacit the knowledge, as it is more difficult to identify tacit knowledge available in the firm, and envision novel ways for its application. Therefore “knowledge that is difficult to codify is likely to be difficult to detect” (Galunic and Rodan, 1998, p. 1196). Second, even if the RR opportunity was being identified, the cost of exchange will be increased, as “knowledge that is difficult to codify will be difficult to transfer in order to combine it with other knowledge in the firm (Teece, 1981)” (Galunic and Rodan, 1998, p. 1196). As a result, both factors will reduce the competence-related knowledge flows across disciplines, which is a prerequisite for stimulating and supporting the creation of novel RRs in firms (Galunic and Rodan, 1998). Accordingly, the extent to which the firm`s knowledge is not formally documented, codified and communicated through written reports, and therefore difficult to transfer and absorb (Szulanski, 1996, Lane et al., 2007), is suggested to negatively affect its transfer and consequently RR in firms.

Based on these arguments, this research postulates that the likelihood of RR will be diminished, the more tacit the knowledge involved, meaning the higher the tacitness of the knowledge within the resource base, the lower the amount of RRs in firms. At the same time this research suggests that the more tacit the knowledge, the more important the firm`s Integration and Coordination capacity (refer to chapter 3.4.2.2.) to unearth the potential value of resources (Madhavan and Grover 1998, De Luca and Atuahene-Gima, 2007) and transfer it into realised value through new RRs.

***H1d** (Resource Transferability): Tacit knowledge is negatively related to RR.*

3.3.5 Resource Deployment Flexibility: Knowledge Context-Specificity

Resource Deployment Flexibility refers to the degree to which the resources available in a firm are generalisable and flexible for being deployed in other areas or applied in other courses of action. Resource deployment flexibility is “the ability of the resources in an organisation’s resource chains to be used in alternative ways, (…)[and] can be described by the range of uses that the resources can be applied to, by the time that it takes an organisation to change the use of a resource and by the costs the organisation incurs to change the use of a resource” (Sanchez, 2004, p. 526). Resource deployment flexibility, thus “depends jointly on the inherent flexibilities of the resources available to the firm and on the firm's flexibilities in applying those resources to alternative courses of action” (Sanchez, 1995, p. 138). In this research, resource deployment flexibility is captured by the **Context-Specificity of the Knowledge,** which describes “the extent to which the firm’s knowledge is tailored to the requirements of specific contexts, in which it is maximally effective but loses its value in other contexts" (De Luca, 2007, p. 98). In a similar vein, Galunic and Rodan (1998, p. 1194) define knowledge context-specificity as "the extent to which knowledge is highly contextualised and codependent on unidentified aspects of the local environment". Accordingly, as knowledge is often found to be highly contextualised, the context in which it is embedded is also an important factor influencing its flow (Galunic and Rodan, 1998).

Notwithstanding that generally knowledge may have multiple uses (Prahalad and Hamel, 1990), for the purpose of specialisation advantages it is often found to be highly customised to a specific use, which diminishes its flexibility for flowing elsewhere (Galunic and Rodan, 1998). De Luca and Atuahene-Gima (2007) for instance propose, that firm`s Market Knowledge can be highly related to a specific customer segment, particular product or market strategy, or behaviour of a specific competitor, and therefore is difficult to being applied to other contexts. Similar examples can be found for Technological Knowledge, where e.g. highly specialised machines may only be of limited use in alternate contexts, depending on their upgradability, scalability, and extendability to modify existing functionalities or add new functionalities (Sanchez, 1995). In both cases, the knowledge acquired is valuable only in the specific context of the focal firm. Thus, highly specialised and valuable resources may turn out to be of little use outside a relatively narrow context for which they were developed (Galunic and Rodan, 1998). Indeed, while this imperfect mobility of context-specific resources may be desirable at the interfirm level, it is regarded as disadvantageous to intrafirm RR (Galunic and Rodan), mainly for the reasoning, that RR requires firm`s to redeploy resources into new resource bundles, with the aim to address deployment strategies that more effectively match resources to the competitive context (Holcombs and Holmes, 2009). Doing so necessitates the transfer of resources to serve new tasks (Sanchez, 1995). The resource deployment flexibility, respectively its context-specificity, therefore is proposed to play a major role for RR in firms.

Accordingly, following the argument by Galunic and Rodan (1998), this research suggests, that the likelihood of RR increases, the higher the deployment flexibility of the resources the firm possesses. Formulated differently, it is suggested that the lower the context specificity (respectively the higher the deployment flexibility) of the resources within the resource base, the higher its potential value for RR, and the higher the amount of RR in firms. Also here, it has to be noted that the relationship of context specific knowledge and the amount of RRs in firm suggested to be influenced by the firms integrating and coordination capacities (refer to chapter 3.4.2.2.)

***H1e** (Resource Deployment Flexibility): Context-specific knowledge is negatively related to RR.*

3.3.6 Resource Renewal: Knowledge Origin

Resource Renewal refers to the degree to which the resources available within the firm`s resource base consist of newly acquired resources, and therefore basically addresses the **Knowledge Origin**. In other words, it captures how much of the knowledge is internally based '*existing*' and how much is externally acquired '*new'*. The general differentiation between *existing* and *new* resources and its importance have extensively been discussed in literature (Connor, 1999; Foster, 1986; Hamel and Prahalad, 1994, Wiklund and Shepherd, 2009). For this research's definition, *existing* resources refer to internal resources that have already been existent for a long time in/ or used by the company, while *new* resources refer to external resources that are not previously known in or used by the company, but have recently been acquired from external sources. This definition is based on the idea that organisational boundaries matter: '*existing*' knowledge is already owned by the firm, while '*new*' knowledge must be imported by the firm from beyond its boundaries (Rosenkopf and Nerkar,2001). The rate of renewal is determined by the ratio of *new* resources relatively to the *existing* resources.

Notwithstanding that existing resources may provide an inherent potential for RR in firms (Galunic and Rodan, 1998), following the argument by Wiklund and Shepherd (2009, p. 195) "there are limitations with reliance solely on resources internal to the firm for generating new productive resource combinations because it is unlikely that the exact same set of resources can be used to develop new and more valuable combinations over and over again". The general perception in literature is that a high internal renewal rate of the resources may lead to a respectively greater amount of new components within the resource base, which in turn build the raw material for RRs, and thus is suggested to provide a greater potential to recombine different elements of that knowledge through building new RRs (e.g. Galunic and Roden, 1998, Wiklund and Shepherd, 2009). A higher internal renewal of the resource base through adding new external resources, thus, may lead to a greater amount of RRs in firms. However, other authors add for consideration that resource renewal per se does not necessarily enhance the potential value of the resource base for RRs, because adding new resources to the existing ones does not ensure the creation of VRIN resources. For instance, a new set of resources may only provide competitive parity, or turn out to be irrelevant in terms of creating value for customers (Helfat et al., 2007, Ambrosini and Bowman, 2009). Therefore, the overall quality and diversity of newly accessed resources may play a considerably larger role than its origin. Yet to control for the potential influence of the knowledge origin on RR, this research suggests that the higher the proportion of new, external resources among the firm`s resources, the higher its potential value for RR, as it may facilitate firms to detect new possibilities for building RRs. However, for the same reasons as outlined before, the effect of newly acquired knowledge on RRs will be moderated by the firm`s Integration and Coordination capacities (refer to chapter 3.4.2.2.).

H1f *(Resource Renewal): New, external knowledge is positively related to RR.*

3.4 Dynamic Capabilities and Resource Recombination

After having outlined and discussed how specific characteristics of the resources may influence the potential value of the resources base for RR, based on these preliminary considerations, the following section specifies Proposition 2 and further elaborates the relationship between DCs and RR in firms.

Proposition 2: A firm`s overall DC is positively associated with the amount of RRs in firms due to both building and exploiting the potential value of the resources base.

The aim is to better understand how the DCs act upon the resource base by building and/ or exploiting the potential value of the resource base and how both constructs (the resource base and the DCs) are linked with the organisational outcome of new, synergetic RRs. In order to investigate the role and effects of DCs in the process of RR in firms, first a framework will be established, describing a specific set of DCs relevant for RR and their suggested interrelations towards RR, where in a subsequent research step based on the conceptualisation of the specific DCs, their role in the process of resource value creation will be investigated in more detail and hypotheses will be derived.

3.4.1 Dynamic Capability Framework

The DC framework builds the conceptual foundation of the firm`s DCs, introducing the four DCs relevant for the process of RR, namely Sensing, Learning, Integrating and Coordinating Capacities, investigating their underlying activities, processes and routines, and outlining their general relation towards RR. Hence the DC framework outlines the microfoundations of DCs with the aim to develop a general understanding of the construct of DC and its underlying dimensions.

A strong motivation for unpacking the microfoundations of DCs is to thereby contribute towards an enhanced understanding and explanation of what drives differences in firm`s behaviour and performance in regard to RR (Felin and Foss, 2005, Gavetti, 2005, Teece, 2007, Abell et al., 2008, Argote and Ren, 2012, Felin et al., 2012).

First, by investigating the microfoundations of DCs, within the DC framework this research will enhance the understanding of the primary components, processes and mechanism, underlying each capacity. Based on a review and categorisation of the multi-faceted capabilities proposed in the literature, the framework will allow defining a set of relevant DCs, specifying its routines and processes, which results in the development of a consistent and precise definition of its exact components. Thus by making the DCs observable and semantically clarified, it addresses the current lack of precise definitions, empirical grounding and measurement (e.g. Pavlou and El Sawy, 2011).

Second, having established an enhanced understanding of the firm`s DCs, this will allow to investigate their role in the process of resource value creation in firms, and thus helps clarifying the sources of heterogeneity in firm`s performance. Investigating the relation between the different types of DCs, the resource base and its performance outcomes allows a more precise understanding of RR in firms and will shed light on how differences in routines and capabilities may contribute towards explaining differences in innovation performance among firms.

The development of the DC framework comprises the following steps. Starting with a review, syntheses and re-conceptualisation of existing approaches of DCs found in the literature, a proposed set of specific DCs relevant for the process of RR will be identified. In a subsequent step, the four identified DCs – Sensing, Learning, Integrating and Coordinating capacity –, their underlying activities, organisational routines and processes will be investigated in more detail. Based on the conceptualisation of the specific DCs, hypotheses are drawn regarding their relationship towards RR. In a last section the suggested interrelations of the DCs among each other are specified. The chapter closes with the presentation of the DC framework, building the conception foundation for the subsequent research steps.

3.4.1.1 Conceptualising Dynamic Capabilities and Organisational Routines

Generally two different approaches towards conceptualising DCs can be found in the literature (Madsen, 2010). The first type of approaches considers DCs as an **evolutionary process** consistent of different stages, basically comprising a variety of decision-making and problem-solving activities undertaken by firms. Representative for this type of approaches, Zollo and Winter (2002) and Zott (2003) describe organisational knowledge to evolve through a series of three stages of: (1) **searching (variation)**, where firms search for new ideas based on the combination of external stimuli and internal resources in response to changing market environments, (2) **selection (evaluation),** where proposed ideas are evaluated based on experience, tested and critically analysed and the most promising ones are selected, (3) **routinisation (retention/ enactment)**, where the selected ideas are implemented through establishing routines (Madsen, 2010). All of which are regarded as evolving learning mechanisms, through which firm`s develop DCs, or in other words the DCs are proposed to be "shaped by the co-evolution of these learning mechanisms" (Zollo and Winter, 2002, p. 2).

A similar concept is presented by Hargadon (2002), who delineates four different knowledge brokering stages: (1) **Access**, (2) **Bridging and Learning**, (3) **Linking,** and (4) **Building**. The first stage *Access* describes a firm`s ability to access information and knowledge, e.g. to predict emerging technologies and future trends and adapt the firm's capabilities to them. Thus by describing the external conditions that "create the potential for innovation (…) by importing useful yet unvalued knowledge" (Hargadon, 2002, p. 57), it rather describes the structural precondition for the RR process. The second stage *Bridging and Learning* refer to the firm`s ability to connect the isolated, otherwise disconnected domains of knowledge and to develop a comprehensive understanding of the business field (Hargadon, 2002). Both stages, *Bridging* different domains of knowledge and thereby *Learning* and transferring new knowledge to existing problems are regarded as essential capacities because "recombinant innovation occur when ideas in one domain are valuable but unknown in others" (Hargadon, 2002, p. 55). The third stage, *Linking* refers to the firm`s ability to link "existing problem definitions and solutions to current situations through a process of analogical reasoning" and thereby to "recognise how past learning can apply to the current situation" (Hargadon, 2002, p. 63). Fourth, *Building* lastly refers to "the activities that individuals and teams use to connect new networks around those new combinations in order to ensure their success" (p. 68 f). All together, the four stages as proposed by Hargadon (2002) are closely related to the three steps **Structuring**, **Bundling**, and **Leveraging**, underpinning the resource management process as proposed by Sirmon et al. (2007) and described in chapter 2.4.3.1. These approaches have in common that DCs are regarded as evolving through a series of evolutionary process stages.

The second type of approaches, which also the conceptualisation of this research is in line with, regards DCs as **organisational capacities and mechanisms** (Madsen, 2010) to integrate, build, and reconfigure internal and external resources to address changing environments (Teece, 2007, Eisenhardt and Martin, 2000). In their early works Teece and Pisano (1994) and Teece at al. (1997) propose three organisational and managerial processes as essential elements of DC, namely (1) **coordination and integrating** of internal and external activities and resources (2) **learning**, referring to repetition and experimentation activities, that enable firms to improve existing functions, and (3) **reconfiguring and restructuring** of resources and the firm's asset structure to enable internal and external transformation (Madsen, 2010).

Later on, in Teece (2007) these processes are further specified and defined as "a subset of the processes that support sensing, seizing and managing threats" (Teece, 2007, p. 1341). Correspondingly, according to Teece (2007) the DC of the firm can be disaggregated into three different capacities: (1) **Sensing Capacities**, (2) **Seizing Capacities**, and (3) **Transformational (Reconfiguring) Capacities.** The first, **s***ensing capacity* relates to identifying and shaping new opportunities in the environment, accordingly "sensing (and shaping) new opportunities is very much a scanning, creation, learning, and interpretive activity" (Teece, 2007, p. 1322). Secondly, *seizing capacity* refers to addressing those new opportunities through new products, processes or services. Thirdly, t*ransformational capacity* relates to maintaining competitiveness through reconfiguring and recombining a firm's resources. Altogether, sensing, seizing and transformational capacities are suggested to build a firm's overall DC and thus enable managers to find new value enhancing resource combinations by means of asset orchestration processes (Helfat and Peteraf, 2009, Teece, 2007). This disaggregation is consistent with (e.g. Marsh and Stock, 2006, Verona and Revasi, 2003), or adapted by other research (e.g. Lichtenthaler, 2012), which based their work in Teece (2007).

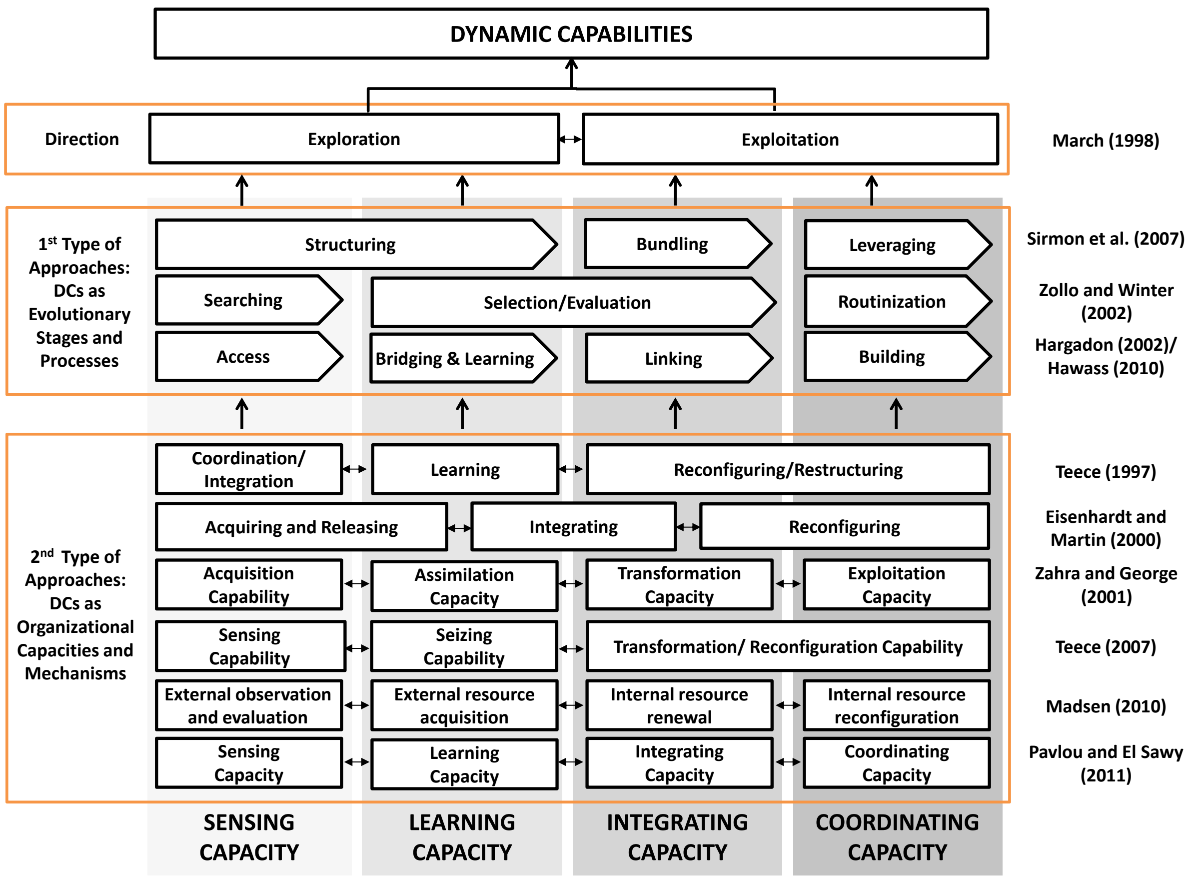
A corresponding conceptualisation is presented by Eisenhardt and Martin (2000), who proposes the firm`s DC to be consistent of three related capacities: (1) DCs for **acquiring and releasing** resources, which is constituted by alliance and acquisition routines, internal knowledge creation routines, as well as routines for knowledge retention and release, (2) DCs for **integrating** resources, which comprise strategic decision making and product development routines, and (3) DCs for **reconfiguring** internal resources, which regard resource placement, adaption and allocation routines, as well as management cooperation routines (Eisenhardt and Martin, 2000).

Coming from a different stream in literature, however also building upon the DC perspective and capturing related constructs, Zahra and George (2001, p. 186) refer to the **Absorptive Capacity** (ACAP) of the firm "as the firm's ability to value, assimilate, and apply new knowledge" to be formed by four different dimensions: (1) the **Knowledge Acquisition Capability** defined as "a firm`s capability to identify and acquire externally generated knowledge that is critical to its operations" (Zahra and George, p. 189), (2) the **Assimilation Capability** referring to "the firm's routines and processes that allow it to analyse, process, interpret and understand the information obtained from external sources" (Zahra and George, p. 189), (3) the **Transformation Capability** representing "a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge" (Zahra and George, p. 190), and lastly (4) the **Exploitation Capability** which is "based on the routines that allow firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired" (Zahra and George, p. 190). While the former two dimensions are supposed to form the *Potential Absorptive Capacity (PACAP)* accountable for incorporating new knowledge, however not being concerned with its exploitation, the latter two dimensions are proposed to denote the *Realised Absorptive Capacity (RACAP)* responsible for leveraging and exploiting the knowledge that has been absorbed.

In a similar vein, the classification by Madsen (2010) differentiates between external and internal processes and propose a firm`s DC to be delineated through four sub-processes: (1) **External observation and evaluation**, which comprise "dynamic capabilities which monitor the environment, provide impulse to new ideas, discover new possibilities and evaluate these" (Madsen, 2010, p. 230), (2) **External resource acquisition**, incorporating DCs relevant for acquiring new, external resources, (3) **Internal resource renewal**, which denotes DCs that "integrate new resources in original and effective resource configurations" (Madsen, 2010, p. 231) and (4) **Internal resource reconfiguration,** relating to DCs concerned with reconfiguring or restructuring internal resources (Madsen, 2010).

Lastly, an important step towards a conceptualisation of the DC construct has been done by Pavlou and El Sawy (2011) by presenting a generic framework and moreover, first measurement model of a set of identifiable and specific DCs for resource reconfiguration. Based on the work by Teece et al. (1997, 2007), Pavlou and El Sawy (2011) distinguish between four related but distinct types of DCs facilitating organisations to integrate, build and reconfigure internal and external resources to address rapidly changing environments, namely (1) **Sensing Capacity**, defined as "the ability to spot, interpret, and pursue opportunities in the environment" (Pavlou and El Sawy, 2011, p. 243), (2) **Learning Capacity**, which refers to the "ability to revamp existing operational capabilities with new knowledge" (Pavlou and El Sawy, 2011, p. 244), (3) **Integrating Capacity**, relating to the "ability to embed new knowledge into the new operational capabilities by creating a shared understanding and collective sense-making" (Pavlou and El Sawy, 2011, p. 245), and (4) **Coordinating Capacity**, describing the "ability to orchestrate and deploy tasks, resources, and activities in the new operational capabilities" (Pavlou and El Sawy, 2011, p. 246).

Figure 3.1 Framework comprising the different Conceptualisations of DCs found in the Literature



Source: own illustration

As the above review has shown different conceptualisations of the DC construct exist in the literature, whereby "different labels have been used in the literature to refer to similar capabilities, or similar labels for different capabilities" (Pavlou and El Sawy, 2011, p. 242). The diversity and complexity of the concept can also be seen in the various definitions that exist in the literature describing DCs (Madsen, 2010), refer to chapter 2.4.3.3. Hence, in order to sort out and bring clarity to the construct of DC, the various labels and meanings used to refer to similar concepts were converted into a framework that comprises the firm`s DC at three levels as suggested by Madsen (2010). Figure 3.1 presents the framework aligning the different concepts found in the literature.

First, at the top level, DCs are developed along two main dimensions *exploration and exploitation*, which relates to the balancing act firms have to accomplish between the two diverging directions of the firm: (1) the exploration of new opportunities on the one hand side, which is directed towards innovation and search, and (2) the exploitation of existing resources, which is more efficiency oriented, on the other (March, 1991). The second level comprises the *evolutionary processes* as such DCs are conceptualised by the first group of approaches (e.g. Zollo and Winter, 2002, Zott, 2003), all of which refer to DCs as something that best can be captured by the different stages, that describe how the process of RR in firms is carried out (Madsen, 2010). Complementing, and thus closely related to these evolutionary processes are the *organisational capacities and mechanism*, which are captured at the third level in the framework, describing the capabilities, capacities or activities relevant for accomplishing the evolutionary processes. As conceptualised by the second group of approaches (e.g. Teece, 2007, Eisenhardt and Martin, 2000, Pavlou and El Sway, 2011), taken together these different *organisational capacities and mechanisms* are suggested to form the firm`s overall DC.

Summarising, the framework as presented in Figure 3.1 allows the different manifestations of DCs described or utilised in the literature to be placed into a holistic frame. Doing so, this framework aligns the different evolutionary processes found in the literature, e.g. searching/ access/ structuring as exploration processes and e.g. routinisation/ building/ leveraging as exploitation processes, with its respective capabilities, capacities and activities (e.g. sensing, seizing and transformation capacities) and thus integrates the varying approaches suggested by different authors. This is valuable as "dynamic capabilities actually consist of identifiable and specific routines that often have been the subject of extensive empirical research in their own right" (Eisenhardt and Martin, 2000, p. 1107). Moreover it emerges, that as different as they seem to be a priori, all of them describe similar, yet related concepts. Accordingly, with the synthesis of the different concepts, the framework allows aggregating the diverse notions found in the literature into **four generic types of DCs**, which – in line with the conceptualisation by Pavlou and El Sawy (2011) – can best be described as **Sensing capacity, Learning capacity, Integrating capacity**, and **Coordinating capacity**.

The following Figure 3.2 presents the generic framework of the proposed set of DCs as presented by Pavlou and El Sawy (2011), briefly describing each capacity and the logical sequence of how each capabilities contributes in the process of RR in order to reconfigure existing resources into new ones that better fit the environmental conditions. Notably, the logical sequence as shown in Figure 3.2 only gives a simplified representation of the interaction effects, which will be further detailed in chapter 3.4.1.6. The generic framework hence gives emphasis that the DC of the firm should be conceptualises as a multidimensional construct, including four very different dimensions of DCs.

Figure 3.2 Generic Framework representing the proposed Set of Dynamic Capabilities

Source: adapted from Pavlou and El Sawy (2011)

While drawing on the conceptualisation of the four generic types of DCs as presented by Pavlou and El Sawy (2011), this research further elaborates the conceptual specifications of the four DCs by aligning them with the conceptual works presented by Sirmon et al. (2007), Zollo and Winter (2002), Hargadon (2002), Hawass (2010), Teece (2007), Teece et al. (1997), Eisenhardt and Martin (2000), Madsen (2010), resulting in a re-conceptualisation of the four DCs, that is more detailed and that allows us to have specific constructs that can be operationalised and measured.

The four generic types of DCs, as presented in Figure 3.2 and defined as relevant for this research, are outlined and discussed in the following section. Moreover a more detailed overview of the diverse notions of DCs found in the literature, organised according to the above framework of the four generic types of DCs, can be found in Appendix 3.1.

3.4.1.2 Sensing Capacity

The firm`s Sensing capacity refers to the identification and development of new opportunities in the environment by means of scanning, screening and interpreting activities. In line with the definition presented by Pavlou and El Sawy (2011) and corresponding to Teece`s (2007) conceptualisation of 'Sensing' as a firm`s capacity responsible for identifying and shaping new opportunities in the environment, this research proposes the following definition:

> ***Sensing capacity*** *is defined as the firm`s ability to spot, interpret and pursue opportunities in the internal and external environment.*

Accordingly, this research`s definition of Sensing capacity is corresponding with Teece (2007, p. 1322) stating: "Sensing (and shaping) new opportunities is very much a scanning, creation, learning, and interpretive activity". Comparable definitions can be found in the literature, Lichtenthaler (2012) for example refers to 'Sensing' as developing new opportunity through environmental scanning, learning, and investments in research and related activities, while Madsen refers to '*External observation and evaluation',* a similar concept with different labelling, which "comprise dynamic capabilities which monitor the environment, provide impulse to new ideas, discover new possibilities and evaluate these" (Madsen, 2010, p. 230).

Sensing new opportunities in the environment fosters RR in firms. For recombinant innovation to occur, firms have to sense the environment to explore technologies and markets to discover and identify new opportunities (Day, 1994, McGrath, 2001). In other words, "Reconfiguration requires a surveillance of market trends and new technologies to sense and seize opportunities" (Pavlou and El Sawy, 2011, p. 243). This is closely related to Armit and Schoemaker`s (1993) perception of identifying *Strategic Industry Factors* at the market side, which they refer to as "a set of Resources and Capabilities that has become the prime determinant of economic rents for industry participants" (Armit and Schoemaker, 1993, p. 93), and which are "determined at the market-level through complex interactions among the firm's competitors, customers, regulators, innovators external to the industry, and other stakeholders" (Armit and Schoemaker, 1993, p. 93). According to Armit and Schoemaker (1993), the rationale deciding about competitive advantages and rent generation in firms is finding the right match between these *Strategic Industry Factors* at the industry level and *Strategic Assets* at the firm level. In this regard, a strong Sensing capacity highly contributes to identifying *Strategic Industry Factors,* which consequently needs to be attended through the development of appropriate internal resources and capabilities (*Strategic Assets*).

In support of this view, as market needs, technological opportunities, and competitor activity are constantly changing especially in today's dynamic environment, according to Teece (1997, p. 521) “there is obviously value in the ability to sense the need to reconfigure the firm's asset structure, and to accomplish the necessary internal and external transformation”. On the downside, “if enterprises fail to engage in such activities, they won’t be able to assess market and technological developments and spot opportunities. As a consequence, they will likely miss opportunities visible to others” (Teece, 2007, p. 1323).

Thus, in order to raise the potential to identify new opportunities for reconfiguration, firms must continuously sense the environment to generate market intelligence by capturing market needs, competitor action, new technologies and market trends (Teece, 2007, Pavlou and El Sawy, 2011, Day, 1994, McGrath, 2001). Establishing the view Teece et al. (1997, p. 521) proposed that “the ability to calibrate the requirements for change and to effectuate the necessary adjustments (…) depend[s] on the ability to scan the environment, to evaluate markets and competitors, and to quickly accomplish reconfiguration ahead of competition.” A strong Sensing capacity hence is regarded as a critical capability of the firm, as it enables a dynamic co-evolvement of the firms capacities and competences and its market-related environment (Teece, 2007, Lichtenthaler, 2012). Specifically, ‘Sensing’ is regarded as essential capacity as is extends the firm`s resource base with new Market Knowledge (Lichtenthaler, 2012).

According to Teece (2007), the identification of new opportunities requires both, the access to information as well as the ability to recognise, sense and shape developments. The relatedness to the knowledge brokering stage ‘*Access*’ as proposed by Hargadon (2002), referring to the firm`s ability to access information and knowledge, e.g. for predicting emerging technologies and future trends and adapt the firm’s capabilities to them, becomes obvious. In line with what literature suggests, Teece (2007) further delineates that opportunity discovery and creation may either be originated in the cognitive and creative capacity of individuals (‘right brain’) or can be grounded in organisational processes and routines. Accordingly, following Teece (2007, p. 1323) in order to anchor a firm`s Sensing capacity ”organizational processes can be put in place inside the enterprise to garner new technical information, tap developments in exogenous science, monitor customer needs and competitor activity, and shape new products and processes opportunities”. Subsequently, establishing processes for embedding scanning, interpretive and creative processes inside the firm, would be the more desirable approach for long term economic growth, rather than solely building firm’s future prospects on the creative or cognitive skills of individuals (Teece, 2007).

In spite of these knowledge, researchers found the ability to identify new opportunities to vary significantly among firms (Teece, 2007). While some firms have already established specific processes and routines supporting the environmental scanning for new opportunities, others are still underemphasised (Lichtenthaler, 2012). Thus, in order to better understand the microfoundations of the firm`s Sensing capacity, it is important to investigate the organisational processes that can be put in place inside the firm and are constituting a firm`s Sensing capacity (Ambrosini and Bowman, 2009).

Sensing capacity, as defined here, comprises the identification of innovation-related assets (Lichtenthaler, 2012), specifically knowledge on market needs (market intelligence), customer needs and competitor moves (customer and competitor intelligence), and new technologies (technological intelligence) in order to identify and shape opportunities (Teece, 2007). Accordingly, the **three basic routines underlying Sensing capacity** involve: (1) **Generating Market Intelligence**, (2) **Generating Customer and Competitor Intelligence**, and (3) **Generating Technological Intelligence**. These routines are related to kindred processes and activities in the DC literature (Pavlou and El Sawy, 2011).

Firstly, *Generating Market Intelligence* relates identifying market opportunities (Day, 1994), being responsive to market trends (Amit and Schoemaker, 1993), recognising rigidities (Sinkula, 1994), and identifying and recognising new business opportunities (Pavlou and El Sawy, 2011, Galunic and Rodan, 1998). Secondly, *Generating Customer and Competitor Intelligence* relates to identifying customer needs (Teece, 2007, Pavlou and El Sawy, 2011), monitoring competitor activity (Teece, 2007), allocating resources to search and discovery activities (Teece, 2007). Thirdly, *Generating Technological Intelligence* relates to identifying technological developments and opportunities (Teece, 2007), gathering new technical information, data, and statistics (Teece, 2007), and taping developments in exogenous science (Teece, 2007).

While generating market, customer and technological intelligence describe the underlying routines, defined as repetitious organisational activities that constituting a firm`s Sensing capacity, following the conceptualisation by Pavlou and El Sawy (2011), each routine can be further described by three **sub-processes. T**hese are **gathering market** (customer and competitor) **intelligence** (Galunic and Rodan, 1998), **disseminating market** (customer and competitor) **intelligence** (Kogut and Zander, 1996) and **responding to market** (customer and competitor) **intelligence** (Teece, 2007). More specifically, these three processes can be further delineated by the following **basic activities** underlying these processes:

(1) Gathering new market (customer and technological) intelligence refers to **spotting, scanning and monitoring the environment** and entails activities, such as (i) to *scan, search,* and *explore* technologies and markets, both ‘local’ and ‘distant’ (Teece, 2007, Nelson and Winter, 1982), (ii) to *scan* and *monitor* technological developments and opportunities, both internal and external (Teece 2007), (iii) to *identify* and *recognise* new business opportunities (Pavlou and el Sawy, 2011), (iv) to *understand* customer decision making processes (Nonaka and Toyama, 2007), (v) to *assess* customer an market needs, both those that are expressed and those that are latent (Teece 2007), (vi) to

identify market and industry trends (Amit and Schoemaker, 1993), and (vii) to *recognise* and *monitor* supplier and competitor moves (Pavlou and el Sawy, 2011, Teece 2007).

(2) Disseminating market (customer and technological) intelligence refers to **accumulating, filtering and interpreting available information** and refers to activities, and captures activities, such as (i) to *accumulate, filter* and *making sense* of information, gained internally and externally (Teece 2007), (ii) to *evaluate* markets and competitors (Teece 2007), (iii) to *build* scenarios about the likely evolution of technology developments, customer needs, suppliers and competitor moves and changing market and technological reality (Teece 2007), (iv) to *understand* customer decision making (Nonaka and Toyama, 2007), (v) to *execute* learning, interpretation, and creative activity (Teece, 2007).

(3) Responding to market (customer and technological) intelligence refers to **valuing, identifying and shaping opportunities** in order to correspond to new developments in the environment, specifically (i) to *assess* for instance, how to interpret new technological and market developments, how technologies will evolve and which technologies to pursue, which market and customer segments to target, or how and when competitors, suppliers, and customers will respond (Teece 2007, p.1322), and (ii) to *initiate* plans on how to capitalise on the new knowledge (D'Aveni, 1994).

The delineation of the key elements of Sensing capacity shows, while Sensing capacity includes the *screening* for external resource acquisition opportunities, it does not capture the acquisition itself, which is part of the Learning capacity. As opposed to Lichtenthaler (2012), who sees external and internal opportunity exploitation being part of 'Sensing', the Sensing capacity as conceptualised here only captures the external opportunity identification. The internal opportunity generation is rather seen as part of the firm`s Learning capacity. Hence, in line with Pavlou and El Sawy (2011, p. 244), this research notes "Sensing and learning capabilities are distinct capabilities because sensing focuses on gathering new market intelligence [external opportunity identification], and learning focuses on using market intelligence [internal opportunity generation] to create new knowledge".

Hypotheses Development

Having established the conceptualisation of Sensing capacity, its underlying routines, processes and activities, allows hypotheses to be derived regarding its relationship towards RR. A firm`s Sensing capacity is proposed to enable reconfiguration of the firm`s resources through its three basic routines and processes (Pavlou and El Sawy, 2011). First, *generating market intelligence* raises the potential to identify new market opportunities for reconfiguration (Zahra and George, 2002, Pavlou and El Sawy, 2011). Second, *generating customer and competitor intelligence* helps to achieve responsiveness to customer needs and competitor moves (Day, 1994, Pavlou and El Sawy, 2011). Third, *generating technological intelligence* helps to identify technological opportunities and developments in the environment (Teece, 2007), which is important to raise the potential for discovering new RR opportunities in the environment.

A strong Sensing capacity thus is found to enhances strategic flexibility, innovativeness, and responsiveness to market trends and customer needs and therefore is proposed to be positively associated with the development of **Market Knowledge**, which refers to the firm's understanding of the market environment, particularly of customers and competitors (Lichtenthaler, 2012, Ramaswami et al., 2009, Teece, 2007). Likewise, an enhanced understanding of the market environment also facilitates taping new developments in the exogenous science, monitoring technological developments and opportunities, which facilitates the identification of technological opportunities (Generating Technological Intelligence). Therefore, in addition, Sensing capacity is proposed to indirectly and positively influence the development of new **Technological Knowledge**[8], which refers to the firm`s technological expertise, R&D as well as engineering skills and competences (Teece, 2007, Thomas et al., 1993, Lichtenthaler, 2012). Given that, a strong Sensing capacity contributes to developing valuable market-related assets (Market Knowledge and subsequently Technological Knowledge), it is an essential capacity for extending a firm's resource base (Lichtenthaler, 2012). As a result, a high Sensing capacity is suggested to positively affect the potential value of the resource base, as it is leading to a higher Market Knowledge (and subsequently Technological Knowledge) breadth and depth.

On this basis, a high Sensing capacity helps to guide the firms RR activities based on the development of a thorough market understanding (Atuahene-Gima et al., 2005, Helfat et al., 2007). In particular, grounded in the market-related assets gained through Sensing, firms can generate additional opportunities for innovation (Ramaswami et al., 2009, Pavlou and El Sawy, 2011). Moreover, by identifying the *Strategic Industry Factors* (Amit and Schoemaker, 1993), the firm`s Sensing capacity contributes to a high market orientation, and as such is regarded as a critical capacity to ensure market-orientated innovation (Lichtenthaler, 2012). Consistent with this view, a high Sensing capacity of firms is proposed to facilitate RR in firms (Pavlou and El Sawy, 2011), as it enables firms to explore external opportunities for new products and services that better meet customer needs (Jaworski and Kohli, 1993). However, a high Sensing capacity *per se* does not ensure a successful realisation of these opportunities, rather it enables identifying *Strategic Industry Factors* and shaping new opportunities in the business environment by means of developing superior understanding of

[8] Generating *Technological Intelligence* is not to be used equivalent to generating *Technological Knowledge*. *Technological Intelligence* is generated through 'Sensing' and as such only concerns the pre-screening and identification of relevant Technological Knowledge, while its acquisition and assimilation would be part of 'Learning'. Therefore 'Sensing' predominantly contributes to generating Market Knowledge and only indirectly affects Technological Knowledge, while Learning contributes to generating Market and Technological Knowledge.

the market environment, which subsequently is likely to be employed and leveraged in form of new RRs (Lichtenthaler, 2012). As such, a high Sensing capacity does not necessary directly link to a higher amount of RR in firms, instead Sensing acts as enabler, identifying new opportunities and providing the market-related knowledge for subsequently seizing these innovation opportunities (Helfat and Peteraf, 2009, Lichtenthaler, 2012).

Consistent with these theoretical research findings, arguments therefore suggest a positive relation between Sensing capacity and RR in firms, through its positive effect on Market and Technological Knowledge. However, this relationship may be influenced by the firm`s Integrating and Coordinating capacities (refer to chapter 3.4.2.2.). This leads to the following hypothesis:

H2: *A high Sensing capacity is positively associated with RR, through Market and Technological Knowledge.*

3.4.1.3 Learning Capacity

Learning capacity refers to the firm`s ability to learn and create new knowledge inside the firm`s boundaries. After sensing new opportunities in the environment, firms have to learn and integrate new knowledge into their own resource base to ensure the availability of relevant internal knowledge for addressing these opportunities (Lavie, 2006, Lichtenthaler, 2012). While Sensing capacity was rather externally oriented towards identifying the *Strategic Industry Factors* at the market side (Armit and Schoemaker, 1993), as it captured the analysis of the external environment and was directed towards external opportunity generation, 'Learning' is rather internally oriented towards building the respective *Strategic Assets* at the firm level. *Strategic Assets* refer to "the set of firm specific Resources and Capabilities developed by management as the basis for creating and protecting their firm's competitive advantage" (Armit and Schoemaker, 1993). In this regard, the firm`s Learning capacity is concerned with the assimilation and accumulation of knowledge in order to build a rich and diverse resource base, the "raw" material for innovation (Hargadon, 2002).

Learning and internally creating new knowledge hence is a critical capacity for RR in firms. In particular, it is essential for building a valuable resource base for RR. Based on the stock of available resources, firms can engage in subsequent, integrative activities, by means of matching *Strategic Assets* developed through Learning, which basically captures the technological-side knowledge (e.g. technologies, resources and capabilities), with *Strategic Industry Factors* identified through Sensing, which refers to the market-side knowledge (e.g. customer needs, market opportunities, etc.) (refer to Figure 3.3). Hence, for firms to take advantage of RR opportunities, they must engage in learning processes (Pavlou and El Sawy, 2011). Likewise, Zollo and Winter (2002) underscore the importance of deliberating learning mechanisms, in the development of internal assets for reconfiguration.

Figure 3.3 Matching Strategic Industry Factors and Strategic Assets

Source: own illustration based on Armit and Schoemaker (1993)

Correspondingly, the firm`s Learning capacity as defined by Pavlou and El Sawy (2011, p. 244) refers to "the ability to revamp existing operational capabilities with new knowledge". This requires the organisations to continuously learn new knowledge and skills, and to renew and maintain existing knowledge to be at the cutting edge for ensuring market orientation (Teece, 2007).

When operationalising the underlying routines of Learning capacity, however, Pavlou and El Sawy (2011) further regard Learning capacity to be equal to the Absorptive Capacity (ACAP) construct as conceptualised by Zahra and George (2002). Hence, the four underlying routines of Learning capacity, as suggested by Pavlou and El Sawy (2011), are proposed to be acquiring, assimilating, transforming, and exploiting knowledge, and in the conceptualisation by Pavlou and El Sawy (2011) capture both the Potential Absorptive Capacity (PACAP) and the Realised Absorptive Capacity (RACAP) dimensions. This research however establishes a different understanding of the firm`s Learning capacity for the following reasoning.

Firstly, the conceptualisation of 'Learning' as presented by Pavlou and El Sawy (2011) considers the ACAP of the firm, which by definition exclusively regards utilising external knowledge within the firm (Cohen and Levinthal, 1990, Lane et al., 2006), and as such neglects the internal learning part (Lane et al., 2006, Zahra and George, 2002). Indeed, internal knowledge generation processes are found to provide substantial input to a firm`s Learning capacity and RR in firms (Khilji et al., 2006, Smith et al., 2005, Hargadon, 2002). Respectively, this research puts forward an integrative picture of how firm`s revamp their knowledge base by managing both internal and external knowledge (Lichtenthaler and

Lichtenthaler, 2009), and in consequence conceptualises Learning capacity as capturing both external knowledge exploration (ACAP) and internal knowledge exploration processes (Knowledge Creation).

Secondly, while seeing ACAP as an essential element of Learning, this research refers to ACAP in its original meaning as formerly proposed by Cohen and Levinthal (1990), when the concept was restricted to the two basic activities of *acquiring* and *assimilating* external knowledge. Accordingly ACAP, as defined for this research, only refers to Knowledge acquisition and assimilation, i.e. the PACAP dimensions conceptualised by Zahra and George (2002). Hence, in distinction from the conceptualisation by Pavlou and El Sawy (2011), while including the PACAP dimensions – covering the firm`s *Knowledge Acquisition Capability* and *Assimilation Capability* – this research refrains from including the RACAP dimensions, compromising *Transformation* and *Exploitation Capability*, for the reason that due to their focus on knowledge exploitation processes the latter two were attributed to Integrating and Coordinating Capacity, respectively.

Thus, by including internal knowledge creation and at the same time excluding the RACAP dimensions within the conceptualisation of Learning capacity, an integrative perspective is adapted for this study. Consequently, Pavlou and El Sawy`s (2011) and Zahra and George`s (2002) definitions have been modified into the following definition of Learning capacity for this study:

> ***Learning capacity*** *refers to the firm`s ability to assimilate, accumulate, retain, and create (new) knowledge to revamp the firm`s resource base with substantial knowledge, developed internally or obtained externally.*

Given this definition, Learning capacity captures two basic components of learning: (1) **external knowledge absorption**, which comprises *knowledge acquisition* and *knowledge assimilation (PACAP)* of external knowledge, and (2) **internal knowledge renewal**, which is seen as a complement to *ACAP* and relates to *knowledge accumulation and retention* of existing, internal knowledge as well as the *internal creation of new knowledge*. This is in line with the perception that resources to be bundled into new RRs can either be developed internally or obtained externally (Wiklund and Shepherd, 2009).

Similar in character, a vast variety of approaches can be found in organisational learning theory elaborating on processes and routines for organisational learning (e.g. Zahra and George, 2002, Sirmon et al., 2007, Pavlou an El Sawy, 2011). Based on the delineation of the concept as defined above, and consistent with earlier research findings from organisational learning theory, **three underlying routines of Learning capacity**, its constituting processes and underlying activities, could be identified: (1) **Acquiring and Assimilating external knowledge**, (2) **Creating new internal knowledge**, and (3) **Accumulating and Retaining internal knowledge.**

(1) Acquiring and Assimilating external knowledge relates to the external knowledge absorption, i.e. PACAP, and captures the processes of *Knowledge Acquisition* and *Knowledge Assimilation*.

Knowledge Acquisition refers to obtaining and integrating new resources from external sources by means of purchasing resources from strategic factor market (Barney, 1986), or alternatively by adapting interorganisational mechanisms for resource exchange, such as strategic alliances, mergers and acquisitions (Capron et al., 1998, Wiklund and Shepherd, 2009), licensing or contractual agreements (Granstrand and Sjolander, 1990). Accordingly, firms acquire knowledge from diverse external sources, whereby the diversity of these sources is suggested to significantly affect the firm`s acquisition and assimilation capabilities (Zahra and George, 2002). This is especially relevant as "the fast changes in consumers' preferences, the increased complexity and costs of developing truly new products, and advances in new technology often require the firm to look beyond its boundaries to access knowledge" (Mu and Di Benedetto, 2012, p. 8). While the internal resources are crucial for a firm`s competitive position over time, "there are limitations with reliance solely on resources internal to the firm for generating new productive resource combinations because it is unlikely that the exact same set of resources can be used to develop new and more valuable combinations over and over again" (Wiklund and Shepherd, 2009, p. 195). Thus, firms increasingly rely on interorganisational knowledge transactions to extend their internal knowledge base (Lichtenthaler and Lichtenthaler, 2009, Argote et al., 2003, Gulati, 1999). Knowledge Acquisition Capability is defined as "a firm`s capability to identify and acquire externally generated knowledge that is critical to its operations" (Zahra and George, 2002, p. 189). Thus, for generating new opportunities to improve performance, external resources must be acquired and integrated with those resources the firm already possesses (Wiklund and Shepherd, 2009, p. 195). This is in line with Cohen and Levinthal's (1990) description of a firm's capacity to value and acquire external knowledge.

Knowledge Assimilation on the other hand refers to understanding the newly acquired knowledge and developing problem-solving skills by means of incorporating them into the firm's knowledge base (Lane et al., 2006, Zahra and George, 2002). It concerns the interpretation, comprehension, and learning of new knowledge (Eisenhardt and Martin, 2000, Zahra and George, 2002), as for instance due to its context specificy, institutionalisation, dispersion, or tacitness, newly acquired knowledge may not always be easily understood, replicated and transferred to new contexts (Leonard-Barton, 1995, Szulanski, 1996, Galunic and Rodan, 1998). The notion that prior knowledge thereby facilitates the leaning of new knowledge is well established in literature (Cohen and Levinthal, 1990, Jansen et al., 2005), suggesting that learning builds upon what is already known by the firm because the memory or stock of knowledge is developed through associative learning (e.g. Cohen and Levinthal, 1990). On the downside, previous activities and resource usage may also limit the probability for learning new knowledge outside those areas the firm already is familiar with, leading to organisational rigidities and structural inertia (Cohen and Levinthal, 1990, Teece, 1987, Leonhard-Barton, 1995). Prior knowledge thus (positively or negatively) influences the comprehension of new knowledge, which in turn is requisite to knowledge assimilation and allows firms to internalise the newly acquires knowledge (Zahra and Geoge, 2002, Lane and Lubatkin, 1998). Knowledge Assimilation Capability refers to "the firm's routines and processes that allow it to analyse, process, interpret and understand the information obtained from external sources" (Zahra and George, 2002, p. 189). Correspondingly, assimilating new knowledge is regarded as an essential part of a firm`s Learning capacity (Pavlou and El Sawy, 2011).

(2) Creating new internal knowledge refers to the internal knowledge exploration and the creation of new knowledge (Rothaermel and Hess, 2007), thus it complements the ACAP dimensions which relates to the external exploration of new knowledge. Prior research has emphasised the importance of firm`s internal inventive and knowledge generation activities (Khilji et al., 2006, Smith et al., 2005). Accordingly, *Internal Knowledge Creation* routine is necessary as "strategic factor markets are unlikely to provide a firm with all its required resources, especially when environmental munificence is low" (Sirmon et al., 2002). Following Nonaka (1991, p. 2), "successful companies are those that continuously create new knowledge, disseminate it widely throughout the company and quickly embody it in new technologies and services". Generating new knowledge inside the firm is also referred to in the literature as internal knowledge exploration (Smith et al., 2005) or inventive capacity (Lichtenthaler and Lichtenthaler, 2009). *Internal knowledge creation* comprises the process stages of internally generating new knowledge (e.g. through inventions resulting from internal R&D), and integrating the new created knowledge into the firm`s knowledge base (Nonaka, 1994, Smith et al., 2005, Lichtenthaler and Lichtenthaler, 2009). Investigating the underlying processes of Internal Knowledge Creation that drive the knowledge-creating company, Nonaka (1991) defines the two critical process steps for creating new knowledge being (1) *Articulation*, which refers to converting tacit knowledge into explicit knowledge, and (2) *Internalisation*, which denotes using the explicit knowledge to extend one's own tacit knowledge.

Looking at the organisational activities underlying these processes, the *Articulation* of knowledge (from tacit to explicit knowledge) refers to the organisational activity of making the tacit knowledge ('know-how') of individuals available to others, by sharing and thus learning the tacit knowledge through articulating the insights and intuitions, and translating it into explicit knowledge, that can be easily communicated and shared with others (Nonaka, 1991). Thus, by sharing their individual opinions, experiences and beliefs and comparing their viewpoints with others, individuals can achieve an improved level of comprehension and draw causal linkages between actions and performance outcomes, which in term foster collective learning (Zollo and Winter, 2002).

Respectively, the *Internalisation* of knowledge (from explicit to tacit knowledge) relates to the organisational activity of sharing the new explicit knowledge throughout the company, which allows others in the company to internalise that knowledge, and thus to broaden, understand and re-frame their own tacit knowledge base (Nonaka, 1991). While kindest activities can be established in firms fostering the articulation and internalisation of knowledge, both processes effort the active involvement of individuals and their personal commitment (Nonaka, 1991). Hence learning "new knowledge always begins with the individual" (Nonaka, 1994, p. 3).

(3) Knowledge Accumulation and Retention refers to the organisational routine of internally managing and retaining knowledge over time (Garud and Nayyar, 1994, Dierickx and Cool, 1989). In a similar vein Lichtenthaler (2009 p. 1315) denotes the 'Knowledge management capacity' as a dynamic capability, which refers "to a firm's ability to successfully manage its knowledge base over time". *Knowledge Accumulation and Retention* is a basic routine of Learning capacity, as the internal knowledge needs to be actively managed and retained to keep the knowledge 'alive' (Lichtenthaler and Lichtenthaler, 2009, Lane et al., 2006). Otherwise, when employees change their positions or leave the companies, or when skills and routines are not used anymore or become obsolete, their firms sustain a loss of knowledge (Szulanski, 1996). To avoid this firms need to accumulate and retain the knowledge about the extant resources, capabilities and organisational skills in ways that enables it to become the raw material for innovation (Hargadon, 2002). Knowledge accumulation and retention captures the processes of *Knowledge Codification* (Coombs and Hill, 1998) and *Unlearning* (Leonhard-Barton, 1995).

Knowledge Codification regards the internal storage of knowledge through formal procedures, knowledge management systems or databases that are employed in order to enhance the sustainability of knowledge and allow knowledge to be maintained, captured and diffused throughout the organisation (Zollo and Winter, 2002, Coombs and Hill, 1998). Knowledge codification is the process by which firms "document understanding of the effectiveness of specific practices" (Marcher and Mowery, 2009, p. 45) through codifying information into formats more suitable for data analysis, e.g. in written tools, such as manuals, blueprints, spreadsheets, decision support systems, project management software, or IT systems (Zollo and Winter, 2002, Coombs and Hill, 1998). Hence, codifiability refers "to the ability of the firm to structure knowledge into a set of identifiable rules and relationships that can be easily communicated" (Kogut and Zander, 1992). *Knowledge Codification* involves actively converting implicit into explicit knowledge, thus helps the process of *Knowledge Articulation* by transferring the knowledge gained into a shared knowledge repository (Marcher and Mowery, 2009, Albino and Garavelli, 2001). Accordingly, *Knowledge Codification* facilitates Learning as is supports the identification of causal linkages through mapping knowledge relationships and enables the systematic management, replication and diffusion of existing knowledge throughout the organisation (Zollo and Winter, 2002, Zander and Kogut, 1995, Nonaka, 1994, Marcher and Mowery, 2009). By providing a 'blueprint' of the firm`s current knowledge, it also helps organisations to capture the internal knowledge available in the firm, and keep track of "knowing what we know", a necessary precondition for RR. In summary, with the codification of otherwise tacit knowledge, it contributes to the firm`s Learning capacity through improved problem solving skills, coordination of available knowledge, knowledge administration and management, knowledge sharing and dissemination (Marcher an Mowery, 2009). However, research also suggest that efforts to capture and codify knowledge in centralised databases cannot substitute the social interactions between individuals working in different areas, rather it is regarded as a supportive process for knowledge management (Hargadon, 1998).

'*Unlearning'* refers to the process of divesting valuable resources or resources that have become obsolete over time (Sirmon et al. 2007, Leonard-Barton, 1992) and removing them from the firm`s resource base. Evidence is given by research that not seldom once functional routines become dysfunctional over time and act as rigidities that keep firms from adapting and acting in ways to improve performance (Leonard-Barton, 1992, 1995, Rumelt, 1987). As firm`s have limited resources, the evaluation of firm-controlled resources and the divestment of less valuable resources is required to generate the slack and flexibility that allows to acquire and accumulate new resources of higher value (Sirmon and Hitt, 2003, Sirmon et al., 2007). As noted by Teece (2007, p. 1333): "By jettisoning 'dead' or dying assets, the enterprise is no longer shackled with an asset base that can be a crutch". Hence, through divesting obsolete assets, firms disentangles oneself of organisational constraints inside its boundaries (Teece, 2007) and create space for resources of higher value.

Looking at the overall concept of Learning capacity as defined here, reveals that it is closely related to the RR process step of 'Bridging and Learning' as defined by Hargadon (2002), were individuals by *bridging* otherwise disconnected domains of knowledge and moving resources from one domain to another, and *learning* new knowledge (be it from external or internal sources) by putting resources in different contexts. Generally speaking, according to Hargadon (2002. p. 62) "learning activities of knowledge brokers entail more than just acquiring knowledge of existing resources within a particular domain", moreover 'Learning' encompasses four activities: (i) learning about the existing resources of each new domain; (ii) learning the related problems in that domain; (iii) learning what others in their own firm know; and (iv) learning how to learn (Hargadon, 2002, p. 58). Thus, learning "describes the set of activities that individuals and groups in organisations engage in to extend their ability to comprehend and act within their environment". (Hargadon, 2002, p. 57).

Hypotheses Development

Given the conceptualisation of Learning capacity, its underlying routines and processes allows hypotheses to be derived regarding its relationship towards RR. A firm`s Learning capacity is proposed to facilitate RR in firms through its three basic routines. First, *acquiring and assimilating external knowledge* helps to obtaining and incorporating new knowledge from external sources and making it available for the firm`s business by integrating it to the firm's knowledge base (Lane et al., 2006, Zahra and George, 2002). Second, as new knowledge does not only emerge externally but also within the firms boundaries, *internal knowledge creation* helps to enhance the current stock of knowledge by internally generating new knowledge through articulation and internalisation (Nonaka, 1994, Smith et al., 2005). Third, *knowledge accumulation and retention* endeavours a continuous retention and maintenance of the internal knowledge available in the firm, thus ensuring a constant renewal of the firm's resource base and keep the knowledge 'alive' (Lichtenthaler and Lichtenthaler, 2009, Lane et al., 2006).

It emerges that Learning is predominantly directed towards developing a valuable stock of knowledge from internal and external sources. The new knowledge gained through Learning hence comprises both **Technological Knowledge** and **Market Knowledge**, as well as the knowledge about the (internal) resources and capabilities. Subsequently, firms can apply the newly created knowledge to further refine and improve existing products and processes (Mu and Di Benedetto, 2012). Accordingly, "Learning builds a rich and diverse knowledge base into these organizations, yet past problems and solutions enter entangled in their original context and often end up in different comers of the organization" (Hargadon, 2002, p. 63). As a result, a high Learning capacity is suggested to positively affect the potential value of the resource base for RR, as it is leading to a higher Market and Technological Knowledge breadth and depth.

On this basis, by developing a rich and diverse knowledge base, Learning capacity is proposed as an enabler of reconfiguration in firms. Supporting this view, Cohen and Levinthal (1990) put forward that the diversity and quality of knowledge available in firms facilitates the innovative process by enabling the individual to make novel associations and linkages. In a similar vein, van den Bosch et al. (1999) argue that 'Learning' facilitates reconfiguration and innovation. Thus, the firm`s Learning capacity is suggested to help firms to accumulate and retain a stock of valuable knowledge about the extant resources, capabilities and organisational skills, in ways that enable it to become the 'raw material' for recombinant innovation (Hargadon, 2002). Likewise Sensing capacity, the firm`s Learning capacity is not assumed to be directly linked to the amount of RR in firms, instead Learning is proposed to act as an enabler of RR, providing the relevant internal knowledge, i.e. the *Strategic Assets*, which have to be matched with the *Strategic Industry Factors* in a subsequent integrating RR step in order to build synergetic RRs and thereby to address the opportunities created by the firm`s Sensing capacity (Helfat and Peteraf, 2009, Lichtenthaler, 2012). Therefore, a higher Learning capacity is suggested to enhance RR in firms, but only if firms possess the necessary Integrating and Coordinating capacities to bundle these resources into new synergetic RRs.

Taken together, these arguments suggest a positive relation between Learning capacity and RR in firms, through its positive effect on Market and Technological Knowledge as it builds the raw material for recombinant innovation. However, this relationship may be further influenced by the firm`s Integrating and Coordinating capacities (therefore refer to chapter 3.4.2.2.). This leads to the following hypothesis:

H3: *A high Learning capacity is positively associated with RR, through Market and Technological Knowledge.*

3.4.1.4 Integrating Capacity

Integrating capacity relates to integrating resources into new, innovative resource bundles. Pavlou and El Sawy (2011, p. 247) define the firm`s **Integrating capacity** as the firm`s "ability to embed new knowledge into the new operational capabilities by creating a shared understanding and collective sense-making" and therewith relate to the firm`s "ability to combine [embed and transfer] individual knowledge into the unit`s new operational capabilities" (Pavlou and El Sawy, 2011, p. 245). However, while embedding new knowledge by transferring individual knowledge to create an collective, organisational knowledge (Nonaka, 1991) is a mandatory process step towards knowledge brokering, it may not be sufficient for new reconfigurations being created (Hawass, 2010). Indeed, the definition, as presented by Pavlou and El Sawy (2011), remains imprecise about how the new operational capabilities are actually being created. The collective and creative activities of bundling, reconfiguring, transforming the resources to build the new operational capabilities are not captured, however needs to be included in the concept.

Bundling thereby refers to "the combining of firm resources to construct or alter [new] capabilities" as described by Sirmon et al. (2007, p. 281), accordingly "resources within the firm's resource portfolio are integrated (i.e., bundled) to create capabilities, with each capability being a unique combination of resources allowing the firm to take specific actions (e.g., marketing, R&D, etc.) that are intended to create value for customers." Hence, the integration of resources into new resource bundles, e.g. operational capabilities, is regarded as a necessary step in exploiting the value creation potential embedded in the firm`s resource base (Sirmon et al., 2007), and therefore represents an important aspect of Integrating capacity.

This is basically what is addressed by the '*Tranformational/Reconfigurational Capability'* as proposed by Teece (2007, p. 1335), who sees the ability to recombine and to reconfigure assets and organisational structures as a key function to sustained profitability and growth in changing environments. He therefore proposes "achieving semi-continuous asset orchestration and corporate renewal, including the redesign of routines" as an essential task of the firm. In a similar vein, Hawass (2010, p. 410) refers to '*Reconfiguration Capability'* as "the organizational art of combining variant domains of knowledge for the purpose of creating new products and technologies". Although solely focussing on the integration of knowledge based assets from *external* sources, similar aspects are entailed in the conceptualisation of '*Transformation Capability'* (as part of the RACAP)**,** referring to "a firm`s capability to develop and refines the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge [e.g. through analogical reasoning]" (Zahra and George, 2002, p. 190). Similar concepts have been proposed in the DC literature spanning '*Integrative Capabilities*' (e.g. Brown and Eisenhardt, 1997, Henderson, 1994), '*Integration Capability*' (e.g. Iansiti and Clark, 1994), or '*Architectural Competence*[9]' (Henderson and Cockburn, 1994), '*Combinative Capacity*[10]` (Kogut and Zander, 1992).

Combining these different aspects outlined above, Integrating capacity in the context of this research is defined as follows:

> ***Integrating capacity*** *refers to the firm`s ability to creatively combine, integrate and transform diverse knowledge based resources in new ways to construct or alter new operational capabilities for the purpose of developing new innovative products or services.*

Integration, as defined here, thus comprises two aspects and will be achieved by, firstly, transferring individual knowledge to the group (resp. organisation) and therewith creating a shared understand-ding and collective sense making, that allows, secondly, to establish new linkages across different domains of knowledge, which result in the creation of new resource bundles (e.g. configurations of existing capabilities in order to develop new products and services). "Integration competencies enable the firm to combine the wide-ranging capabilities, information, and perspectives necessary to develop products that succeed in the marketplace" (Fowler et al., 2000, p. 363, going back to Grant, 1996). Integration, thus, refers to horizontal communication, as opposed to hierarchical communication (Germain and Dröge, 1997). Thus according to Germain and Dröge (1997, p. 621) "as knowledge is developed within more decentralised or specialised units, managers may increasingly

[9] Henderson and Cockburn (1994, p. 66) define *Architectural Competence* as "the ability to access new knowledge from outside the boundaries of the organization and the ability to integrate knowledge flexibly across disciplinary (…) boundaries within the organization."

[10] *Combinative Capabilities* refers to "the intersection of the capability of the firm to exploit its knowledge and the unexplored potential of the technology, or what Scherer (1965) originally called the degree of "technological opportunity" (Kogut and Zander, 1992, p. 391)

view integration as a necessary mechanism to combat excessive compartmentalisation of that knowledge". Integrating capacity as defined here is closely related to the resource management process step of 'Linking' (Hargadon, 2002) were "Individuals and groups, in this stage, exert analogical thinking efforts to handle current problems by extracting new solutions from previously learned domains of knowledge" (Hawass, p. 410).

Also empirical evidence is giving support to these assumption, for instance Hendersen and Chockburn (1994) found a firm`s *Architectural Competence* to be positively associated with research productivity, as measured by number of patents (Hendersen and Chockburn, 1994). Similar results were revealed by Iansiti and Clark (1994), who found that the firm`s Integrating capacity was to be positively related to firm`s performance outcome. Both studies give emphasise on the importance of knowledge integration skills (Teece, 2007).

Looking towards the micro-level origins of Integrating capacity, Hendersen and Chockburn (1994) propose two major aspects of integrating competence relevant for appointing it as sources of enduring competitive advantage: (1) the ability to access new knowledge (resources) from outside the boundaries of the organisation and (2) the ability to integrate knowledge (resources) flexible across disciplines within the organisation. The access to new internal and external knowledge is already provided by Sensing and Learning capacities of the firm, accountable for establishing a high valuable resource base. Given this, it depends on the firm`s Integrating capacity to exploit that knowledge by developing a shared understanding and interrelating different knowledge areas ("bringing the different parts of the puzzle together") for the purpose of developing new resource configurations.

While diverse processes and mechanisms supporting the integration of resources have been denoted in literature (e.g. Henderson and Clark, 1990, Felin et al., 2012, Hawass, 2010), there still is a lack of consistent definition of its underlying routines. Based on, but at the same time slightly extending the conceptualisation of Integrating capacity as proposed by Pavlou and El Sawy (2011), that captures the *contribution, representation* and *interrelation* of individual input to the entire business unit, this research proposes the following **three underlying routines of Integrating capacity**, its constituting processes and underlying activities, as referred to in the DC literature:

(1) Transforming individual to collective knowledge refers to the processes of *contribution* and *representation* of individual and group knowledge as proposed by Pavlou and El Sawy (2011). *Contribution* relates to disseminating individual knowledge to the group or business unit (Okhuysen and Eisenhardt, 2002), while *representation* refers to the understanding of peoples` tasks and responsibilities, as well as knowledge and skills (Crowston and Kammerer, 1998). This is important “because the reconfiguration of existing operational capabilities requires a collective logic and shared interaction patterns” (Pavlou and El Sawy, 2011, p. 245). As the new knowledge created by Learning is usually held by individuals, it has to be transferred to a collective level (Teece, 1982, Pavlou and El Sawy, 2011, Argote and Ren, 2012). This is especially relevant in the context of this research as firm`s capabilities and competences are supra-individual, meaning they do not reside in an individual person but on the organisational level (Pavlou and El Sawy, 2011). Accordingly, both processes *contribution* and *representation* are regarded as essential processes in order to create a shared understanding and collective sense making, and thus a common ground (Argote and Ren, 2012, Weick and Roberts, 1993). Relating to these processes, kindest fundamental knowledge exchange and communication activities can be found in the literature, such as (i) to contribute individual knowledge to the business unit (Okhuysen and Eisenhardt,2002), (ii) to make personal knowledge available to others in the firm (Nonaka, 1991) (iii) to facilitate communication flows, internal networks, technology and personal interaction (Sirmon et al., 2007), (iv) to execute collective, intradepartmental activities (e.g. regular team meetings, knowledge exchange, jour fixe) (Conway, 1995), (v) to encourage informal communication and social relationships between employees (Homburg, 2000), (vi) to interrelate actions to each other to meet changing conditions (Pavlou and El Sawy, 2011), (vii) to establish gatekeeping or boundary-spanning roles who monitors the environment and translates the technical information into a form understandable to the research group (Cohen and Levinthal, 1990).

(2) Interrelating different knowledge domains refers to the processes of *interrelation* of diverse knowledge inputs to the collective system (Grant, 1996) and the *execution* of collective activities (Helfat and Peteraf, 2003), which is suggested to harvest the benefits from analogical reasoning by enabling individuals to spot “hidden similarities” between otherwise isolated domains of knowledge and technologies and successfully transfer their principles to new contexts (Hawass, 2010, Hargadon, 1998). It thus facilitates the creative and effective recombinant search for innovation (Helfat and Peteraf, 2003). Both processes thus enable firms to reconfigure their resources “by gaining access to a wide range of industries, learning the diverse knowledge that resides within these different industries, linking this past knowledge to solutions for current problems, and finally, implementing these new solutions into forms of new products or processes” (Hargadon, 1998, p. 225). This is in line with this research`s underlying perception that “the realization of resource recombinations depends upon the flow of competency-related knowledge between competence areas” (Galunic and Rodan, 1998, p. 1195), and thus concerns the intra- and interdepartmental, as well as the interorganisational knowledge exchange. Accordingly, effectively interrelation of different knowledge domains is seen as an essential element of successful reconfiguration, as “reconfiguration requires collective efforts to relink various ‘webs of collaborations’ across organizational borders to generate creative combination of existing capabilities” (Hawass, 2010, p. 410, with reference to Eisenhardt and Martin, 2000).

Kindest activities underlying these processes can be found in the DC literature, such as (i) to *foster* competence-related knowledge flows among isolated competence areas (e.g. Nonaka and Takeuchi, 1995, Galunic and Rodan, 1998), (ii) to *establish* regular patterns of interactions and information-sharing, that enable the transfer, recombination, and use of knowledge from different functions within the firm (De Luca and Atuahene-Gima, 2007), (iii) to *integrate* different functional areas by building cross-functional teams (Sirmon et al., 2008), (iv) to *foster* interdepartmental information exchange, interaction and connectedness (Menon, 1997, Jaworski and Kohli, 1993), (v) to *exchange* and *adopt* knowledge and technologies between individuals working in various industry sectors, organisations and domains to foster innovation (Lerdahl, 1999), (vi) to *move* people possessing tacit knowledge to different areas in the firm and thereby to *allow* socialisation to inspire new combination.

(3) Reconfiguration and refinement lastly captures the internal integration and transformation processes. Following the definition by Galunic and Rodan (1998, p. 1195): “Resource recombination concerns itself with how the knowledge embedded within a competence may have to be untangled, altered, and integrated with other knowledge bases to create novel business concepts and/or competencies.” Accordingly the routine of reconfiguration and refinement lies in the heart of RR. It captures the processes of *capability transformation* and *capability evolution* as proposed by Lavie (2006). Both are processes undertaken in order to change the firm`s current capabilities and are concerned with the actual reconfiguration and refinement of its current resources.

Capability transformation refers to modification and improvement of existing capabilities through the integration of new knowledge domains to existing ones (reconfiguration), thus it aims “to inject and incorporate new domains of knowledge to the existing organizational system” (Hawass, 2010, p. 412). The transformed capability hence is the outcome of combining internal knowledge with new externally acquired knowledge, and comprises the modification and improvement of existing capabilities through the integration of new knowledge domains to existing ones (Hawass, 2010). Capability transformation thus basically depends on the firm`s ability to integrate the newly acquired knowledge to form new resource bundles.

Capability evolution instead refers to integration and synthesis of the existing resources in new ways (refinement). In other words it refines existing capabilities “by creatively reconnecting existing organizational systems” (Hawass, 2010, p. 412) with the aims to detect and view “potentially new interrelationships among its existing domains of knowledge” (Hawass, 2010, p. 412). This is in line with Galunic and Rodan (1998, p. 1195) stating that RR may be generated through “the synthesis of existing competencies” or through “reconfiguring the ways in which competencies are linked to jointly achieve some broader purpose”. Capability evolution thus predominantly depends “on the firm’s internal sources of knowledge and the extent to which it views potentially new interrelationships among its existing domains of knowledge” (Hawass, p. 412). Focusing on the modification and extension of existing capabilities the process of capability evolution is directed towards exploitation (March, 1991).

Both *capability evolution* and *transformation* relate to innovative problem-solving (Iansiti and Clark, 1994), brainstorming (Pisano, 1994), and creative new thinking (Henderson and Cockburn, 1994), and also here kindest activities can be found in the DC literature, such as (i) to *creatively combine* and *connect* a firm’s current domains of knowledge with new other domains located elsewhere in the industry (Hawass, 2010), (ii) to *integrate* capabilities into comprehensive sets of value-creating organisational skills (Hamel and Prahalad, 1990), (iii) to *identify* two apparently incongruous sets of information and then combine them to arrive at a new schema (Zahra and George, 2002), (iv) to *recognise* non-obvious similarities through building analogies to previously known problems (Hawass, 2010, Hargadon, 1998), (v) to *create* innovative solutions by *linking* past experiences to the current situations they face (Sirmon et al., 2008) , (v) to *adapt* and *interconnect* knowledge and technologies from different industry sectors and knowledge domains (Lerdahl, 1999).

Hypotheses Development

The conceptualisation of Integrating capacity allows hypotheses to be drawn concerning its effects towards RR. As delineated above, the firm`s efforts on developing a high Integrating capacity is intended to result in integrating resources into new resource bundles. This is consistent with the view that in its heart reconfiguration bears on integrating new resources, knowledge, and assets and the reconfiguration of existing resources (Pavlou and El Sawy, 2011, Galunic and Eisenhardt, 2001).

Hence, not surprisingly the firm`s Integrating capacity is proposed to facilitate RR in firms through its three basic routines. First, *transforming individual to collective knowledge* through *representation* and *contribution* of individual and group knowledge helps to create a shared understanding and collective sense making. Second, because RR depends upon competency-related knowledge flows between competence areas (Galunic and Rodan, 1998), *interrelating different knowledge domains* allows firms, once through the *interrelation* of various knowledge areas and at the same time through the *execution* of collective activities, to discover untapped linkages between otherwise isolated knowledge areas and technologies, and thus facilitates the creative and effective search for recombinant innovation. Third, *reconfiguration and refinement* of its resources allow firm´s to actu-ally change current capabilities, both through the reconfiguration of existing capabilities with new, external knowledge (capability transformation) or the refinement and synthesis of the existing capabilities and resources in new ways (capability evolution), in order to develop new, synergetic RRs.

Taken together, these theoretical arguments suggest a positive relationship between a firm`s Integrating capacity and RR in firms. Accordingly, it can be proposed that the higher the firm`s Integrating capacity, the more likely it is for firms to be able to realise novel RRs. Therefore, this research develops the following hypothesis:

H4: *A high Integrating capacity is positively associated with RR.*

3.4.1.5 Coordinating Capacity

> ***Coordinating capacity*** *refers to the firm´s ability to orchestrate and deploy tasks, resources, and activities in new operational capabilities in order to implement new, innovative products or services (RRs) in the market.*

This definition goes back to Pavlou and El Sawy (2011) and is based on the assumption that any new synergetic RR to be realised and implemented in the market, requires a change of existing operational routines and therefore necessitates an effective coordination of tasks and resources, as well as the synchronisation of activities (Iansiti and Clark, 1994, Helfat and Peteraf, 2003, Pavlou an El Sawy, 2011). The firm`s Coordinating capacity thus enables reconfiguration being put into place "by administering tasks, activities, and resources to deploy the reconfigured operational capabilities" (Pavlou and El sawy, 2011). This is in line with Teece et al. (1997), who argue "[the firm`s dynamic] capability is embedded in distinct ways of coordinating" (p. 519).

Coordinating capacity is regarded as a necessary capacity to exploit the value creation potential of the resources by implementing and exploiting new products and services. Hence, the conceptualisation of Coordinating capacity is closely related to the resource management process step '*Leveraging'* as proposed by Sirmon et al. (2007), which focuses on the exploitation of market opportunities. Following Sirmon et al. (2007, p. 283), "effective leveraging is important, in that even when a firm owns or controls resources and has effectively bundled them to develop capabilities with value-creating potential, the firm is unlikely to realise value creation unless it effectively leverages/uses those capabilities in the marketplace". The implementations of new combinations in the market goes along with the resource management process step '*Building*' as described by Hargadon (2002, p. 69), which refers to "the activities that individuals and teams use to connect new networks around those new combinations in order to ensure their success." Another related concept is the '*Exploitation capability*' suggested as sub-component of the realised absorptive capacity (RACAP), and referring to "the routines that allow firms to refine, extend, and leverage existing competences or to create new ones by incorporating acquired and transformed knowledge into its operations" (Zahra and George, 2002, p. 190). Therefore, the results of those systematic exploitation routines are the sustainable creation of new goods, systems, processes, knowledge, or new organisational forms (Spender, 1996). Accordingly, a firm`s Coordinating capacity is an essential capacity for value realisation supporting the leveraging process as it enables the configurations to be coordinated and deployed in appropriate ways to create value for the customers (e.g. Pavlou and El Sawy, 2011, Sirmon et al., 2007).

Likewise other DCs, Coordinating capacity is suggested to be constituted by specific organisational routines. Hence, a variety of established processes used by firms to systematically build or support a firm`s Coordinating capacity can be found in the literature. Pavlou and El Sawy (2011, p. 246) refer to four **basic routines underlying the Coordinating capacity**, comprising (1) assigning resources to tasks (Helfat and Peteraf, 2003) (2) appointing the right person to the right task (Eisenhardt and Brown, 1999), (3) identifying complementarities and synergies among tasks and resources (Eisenhardt and Galunic, 2000), and (4) orchestrating collective activities (Henderson, 1994). Extending the conceptualisation by Pavlou and El Sawy (2011) and aligning it with the three leveraging routines, *mobilising*, *coordinating* and *deploying,* as presented by Sirmon et al. (2007), a more detailed description of the routines underlying the firm`s Coordinating capacity is presented. Coordinating capacity, thus, can be described by the following three basic routines and corporate-level processes that form the capacity, and its underlying activities:

(1) **Allocating and Mobilising Resources** describes the routine, resp. processes of identifying the resources, capabilities, and skills needed to design the capability configurations necessary to exploit opportunities in the market (Sirmon et al., 2007). Thus it helps to provide a plan or vision of those resources, capabilities, and skills needed to form the requisite capability configurations (Sirmon et al., 2010) and comprises activities such as: (i) to *understand* the market and customer needs to guide the design of capability configurations (Sirmon et al., 2007), (ii) to *recognise, assemble,* and *allocate* resources (Collis, 1994, Pavlou and El Sawy, 2011), (iii) to *appoint* the right person to the right task (Eisenhardt and Brown, 1999, Pavlou and El Sawy, 2011), (iv) to *assign* resources to tasks (Helfat and Peteraf, 2003, Pavlou and El Sawy, 2011), and (v) to continuously *orchestrate* assets, involving the alignment, coalignment, realignment, and redeployment of assets (Teece, 2007). The effective allocation of resources, thus, is seen as an essential element of successful reconfiguration, as it increases firm`s flexibility by enabling them to appoint the right people to the right tasks (Eisenhardt and Brown, 1999, Pavlou and El Sawy, 2011),

(2) **Coordinating and Orchestrating Resources** describes the routine resp. processes of coordination and orchestration of identified resources, capabilities and skills for being deployed into effective yet

efficient capability configurations (Sirmon et al., 2007, 2010). It involves activities such as: (i) to *possess* knowledge about the value of individual capabilities, resources and skills (Sirmon et al., 2007), (ii) to *orchestrate* individual tasks and collective activities (Henderson, 1994, Pavlou and El Sawy, 2011), (iii) to *synchronise* tasks and activities (Helfat and Peteraf, 2003), (iv) to *identify* complementarities and synergies among tasks and resources (Eisenhardt and Galunic, 2000, Pavlou and El Sawy, 2011), and (v) to *redeploy* and *reconfigure* resources (Capron et al., 1998). The efficient coordination and orchestration of resources is regarded as essential element for reconfiguration as it helps to manage the resources in efficient and appropriate manners.

(3) **Implementing and Deploying new configurations** lastly describes the routine resp. processes of the physical implementation and deployment of new configurations in the market to leverage and exploit resource opportunities formed by the prior activities and sub-processes (Sirmon et al., 2007, 2010). It involves activities such as: (i) to *implement* and *deploy* the reconfigured operational capabilities (Pavlou and El Sawy, 2011), (ii) to *leverage* resources and knowledge to *exploit* new product ideas (Teece, 2007), (iii) to *realise* the leveraging strategy to create value for customers (Alvarez and Barney, 2002), (iv) to *recombine* and *(re)deploy* resources in reconfigured combinations (Teece, 2007). The physically implementation and deployment of resources in new configurations is regarded as necessary element for reconfiguration as it finally puts them into operation.

Hypotheses Development

Given the conceptualisation of Coordinating capacity, effective coordination results in the leveraging of existing and new resources by implementing them in new effective configurations (Pavlou and El Sawy, 2011). Hence, Coordinating capacity is proposed to facilitate RRs to be successfully implemented in the market through its three basic routines. First, it enables firms to effectively allocate and mobilise resources (Collis, 1994, Pavlou and El Sawy, 2011) by identifying and assigning the resources, capabilities, and skills needed to design the capability configurations necessary in order to exploit opportunities in the market opportunities (Sirmon et al., 2007). Second, through a systematic coordination and orchestration of tasks and resources (Henderson, 1994, Pavlou and El Sawy, 2011), as well as the synchronisation of activities (Helfat and Peteraf, 2003), it enables the reconfiguration and redeployment of resources in the form of new RRs (Capron et al., 1998). Third, Coordinating capacity further helps to efficiently leverage the firm`s resources and knowledge by deploying them in reconfigured operational capabilities that allow to implement and exploit new product ideas. Overall, Coordinating capacity is regarded as essential element for reconfiguration as resources must be coordinated and implemented in appropriate ways to create value. Thus, Coordinating capacity helps to implement and to deploy RR in firms through orchestrating individual tasks and activities.

Summarising the above arguments, this research suggests a positive relation between Coordinating capacity and RR to be in place, as the firm`s Coordinating capacity helps to exploit the value creation potential of the resources by implementing and exploiting new products in the market. These arguments lead to the following hypothesis:

H5: *A high Coordinating capacity is positively associated with RR.*

3.4.1.6 Interrelationships between Sensing, Learning, Integrating and Coordinating Capacity

While the proposed framework (refer to Figure 3.2 in chapter 3.4.1) presents the four DCs as interacting in a sequential logic to reconfigure existing operational capabilities, it only represents a simplified image of reality where interrelations exist between Sensing, Learning, Integrating and Coordinating capacity. Thus, although the four DCs are distinct capacities, there are reciprocal relationships among these capabilities, as already partially theorised in the description of the proposed DCs. This implies that the four capacities are not mutually exclusive, in fact high levels of capacities can coexist, leading to potential interdependencies (Helfat at al. 2007).

While both, Sensing and Learning capacity are regarded as distinct capacities, in line with Pavlou and El Sawy (2011), a reciprocal two-way relationship between Sensing and Learning is proposed to be existent. While Sensing focuses on the identification of new opportunities in the external environment, Learning focuses in internal opportunity generation. Therefore, a strong Sensing capacity is suggested to facilitate the firm`s ability to address external opportunities through learning new and utilising existing knowledge (Pavlou and El Sawy, 2011). Moreover, a high Sensing capacity is suggested to further comprise potential constraints enforced by the scarcity of internal resources as it enhances the identification of opportunities for external resources acquisition (Katila and Ahuja, 2002, Lichtenthaler, 2012). On the other side, the firm`s Learning capacity may also enhance the firm`s ability to detect new opportunities in the environment, this is suggested as prior knowledge facilitates the detection of new knowledge (Cohen and Levinthal, 1990, Zahra and George, 2002).

Additionally, a high Sensing capacity determines the innovation opportunities that may be seized by integrating resources in new ways to construct or alter new operational capabilities, therefore a high Sensing capacity is proposed to also positively affect the firm`s Integrating capacity (Helfat et al., 2007, Lichtenthaler, 2012).

In a similar vein, Integrating and Coordinating capacity are conceptualised as distinct capacities, whereby Integrating focuses on interrelating different knowledge areas and building a shared understanding (Galunic and Eisenhardt, 2001), while Coordinating focuses on orchestrating tasks and activities for deploying new RRs (Pavlou and El Sawy, 2011). Nonetheless, a strong Integrating capacity is proposed to positively affect the firm`s Coordinating capacity, as coordination is facilitated through a shared understanding and collective sense making (Galunic and Eisenhardt, 2001, Pavlou and El Sawy, 2011).

Besides Integrating, also the firms Learning capacity is suggested to positively affect the firm`s Coordinating capacity, as 'Learning' not only contributes towards developing new knowledge, but also adds to comprehensive knowledge about the internal resources and capabilities available for the firm (Hargadon, 1998), which is an essential condition for effective coordination and allocation of resources, tasks and activities (Sirmon et al., 2010).

Notably, even though the four DCs are theoretical distinct capacities with each single capacity offering a unique component to the overall DC (Pavlou and El Sawy, 2011), there are reciprocal relationships among these capabilities, and these interrelations are a constituent part of the conceptual model and hence need to be considered in the measurement model.

3.4.1.7 The Dynamic Capability Framework

Summarising the research findings so far, this section presents the DC framework and gives an overview of the proposed set of DCs as discussed and re-conceptualised in the previous sections. The DC framework builds the conceptual basis for this research. In this chapter one major aim was to unpack the microfoundations of DCs and to develop a general understanding of the construct of DC and its underlying dimensions. The study has gone some way towards enhancing our understanding of the primary components underlying each capacity. These findings, in turn, allow in a subsequent research step to explore how these components interact with their environment and what role they have in value creation in firms, and hence will shed light on how differences in routines and capabilities may contribute towards explaining heterogeneity in innovation performance among firms.

Table 3.1 presents the DC framework and gives an overview of (1) the *definitions* of the four DCs relevant for RR, (2) the *related step in the resource management process* by Hargadon (2002), (3) the *core activities* related to each capacity, as well as (4) the *underlying routines* and *processes* constituting each capacity. The framework allows a synthesis of most of the processes and routines found in the DC literature, and allows their categorisation under each capacity (Pavlou and El Sawy, 2011). This ensures that the framework presented is closely linked to the processes and routines found in the DC literature.

Table 3.1 Dynamic Capability Framework

Sensing Capacity: Sensing new opportunities in the environment

Definition: The ability to spot, interpret and pursue opportunities in the internal and external environment. (Pavlou and El Sawy, 2011)

Related Resource Management Process Step: Access knowledge (Hargadon, 2002)

Core Activities: Scanning, Identifying & Recognising

Basic Routines and Processes:

(1) Generating Market Intelligence
- Generating market intelligence (Galunic and Rodan, 1998):
- Identifying market opportunities (Day, 1994)
- Being responsive to market trends (Amit and Schoemaker, 1993)

(2) Generating Customer and Competitor Intelligence
- Monitoring customer needs (Teece, 2007, Pavlou and El Sawy, 2011)
- Observing competitor activity (Teece, 2007)
- Allocating resources to search and discovery activities (Teece, 2007)

(3) Generating Technological Intelligence
- Identifying technological developments and opportunities (Teece, 2007)
- Gathering new technical information, data, statistics (Teece 2007)
- Taping developments in exogenous science (Teece, 2007)

Intention: to raise the potential to identify new market opportunities for coonfiguration

Learning Capacity: Absorptive Capacity & Knowledge Creation

Definition: The ability to assimilate, transform and create (new) knowledge to revamp the existing resource base with new knowledge, created internally or obtained externally (Pavlou and El Sawy, 2011)

Related Resource Management Process Step: Bridging and learning (Hargadon , 2002)

Core Activities: Acquiring, Transforming & Creating new knowledge

Basic Routines and Processes:

(1) Acquiring and Assimilating external knowledge

= External Knowledge Absorption (Cohen and Levinthal, 1990)
- *Knowledge acquisition* of external resources (Cohen and Levinthal, 1990)
- *Knowledge assimilation* of external resources(Eisenhardt and Martin, 2000)

(2) Creating new internal knowledge

= Internal knowledge creation (Rothaermel and Hess, 2007)
- *Articulation*, converting tacit knowledge into explicit knowledge (Nonaka, 1991)
- *Internalisation*, using the explicit knowledge to extend tacit knowledge (Nonaka, 1991)

(3) Accumulating and Retaining internal knowledge

= Internal Knowledge Management and Retention
- *Knowledge codification* and maintenance (Zollo and Winter, 2002)
- *Knowledge 'unlearning'* (Leonard-Barton, 1992, 1995)

Intention: to build a rich and diverse resource base, the "raw" material for innovation

Integrating Capacity: Integrating resources into new innovative resource bundles

Definition: The ability to creatively combine, integrate and transform diverse knowledge based resources in new ways to construct or alter new operational capabilities for the purpose of developing new innovative products or services

Related Resource Management Process Step: Linking (Hargadon, 2002)

Core Activities: Communicate, Integrate & Bundle

Basic Routines and Processes:

(1) Transforming individual to collective knowledge
- *Contribution* of individual knowledge to the unit (Okhuysen and Eisenhardt,2002)
- *Representation* of individual and group knowledge (Crowston and Kammerer, 1998)

(2) Interrelating different knowledge domains
- *Interrelation* of diverse knowledge inputs to the collective system (Grant,1996)
- *Execution* of collective activities (Helfat and Peteraf, 2003).

(3) Reconfiguration and refinement of resources
- *Capability evolution*: refinement and synthesis of existing capabilities in new ways (Lavie, 2006, Hawass, 2010, Galunic and Rodan, 1998)
- *Capability transformation*: reconfiguration of existing capabilities with new knowledge (Lavie, 2006, Hawass, 2010, Galunic and Rodan, 1998)

Intention: to exploit the value creation potential of the resources by creating new innovative products and services

Coordinating Capacity: Coordinating and deploying tasks and allocating resources

Definition: The ability to orchestrate and deploy tasks, resources, and activities in the new operational capabilities to in order to develop new, innovative products or services (based on Pavlou and El Sawy, 2011)

Related Resource Management Process Step: Building (Hargadon, 2002)

Core Activities: Allocate, Coordinate & Implement

Basic Routines and Processes:

(1) Allocating and Mobilising Resources
- *understand* market needs for designing capability configurations (Sirmon et al., 2007)
- *recognise, assemble,* and *allocate* resources (Collis, 1994, Pavlou and El Sawy, 2011)

(2) Coordinating and Orchestrating Resources
- *possess* knowledge about capabilities, resources and skills (Sirmon et al., 2007)
- *orchestrate* individual tasks and collective activities (Henderson, 1994, Pavlou, 2011)

(3) Implementing and Deploying new configurations
- *implement* and *deploy* the reconfigured operational capabilities (Pavlou and El Sawy, 2011)
- *leverage* resources and knowledge to *exploit* new product ideas (Teece, 2007)
- *realise* the leveraging strategy to create value for customers (Alvarez and Barney, 2002)
- *recombine* and *(re)deploy* resources in reconfigured combinations (Teece, 2007)

Intention: to exploit the value creation potential of the resources by implementing and exploiting new products and services

The framework shows that Sensing, Learning, Integrating and Coordinating Capacities are conceptualised as distinct sub-components of the firm`s overall DC, all of them have different functions in managing a firm`s RR activities over time (Pavlou and El Sawy, 2011). While the proposed set of DCs are neither intended to be exhaustive, nor sufficient for reconfiguration to take place, they are considered as being essential capacities in the process of RR (Pavlou and El Sawy, 2011).

In line with Pavlou and El Sawy (2011) this research suggests that the four DCs – Sensing capacity, Learning capacity, Integrating capacity and Coordinating capacity – intersect with each other and all together build a firm`s overall DC. The framework is based on the perception that regards the overall DC of the firm as a multidimensional construct, formed by four very different sub-dimension. This is in accordance to Brown and Eisenhardt (1997), who consider the firm`s overall DC as complex combinations of simpler routines (Pavlou and El Sawy, 2011). However, when operationalising the DC construct, the few empirical studies that exist in the DC literature, predominantly applied composite (aggregate) approaches to investigate the firm`s DC (e.g. Pavlou and El Sawy, 2011, Madsen, 2010) and hence tend to lump all sub-capabilities together under the 'umbrella of an overall DC'. Therefore, prior works often sustained a loss of explanatory power.

Thus, in distinction to previous research rather than choosing an aggregate approach, this research purposefully distinguishes between the subset of the four different DC, which in turn are suggested to have different effects and 'working modes' towards the resource base and RR. Accordingly, the DC framework established here with its differentiation of the four related but distinct DCs, allows in a subsequent research step to have a more detailed look on the role and effects of each specific DC. Hence, the DC framework presented assists in building a deeper understanding of the role of DCs in the process of RR and allows examining the relationships between the DCs, the resource base and RR in firms, which have been highlighted as important research area in prior research (Ambrosini and Bowman, 2009, Helfat et al., 2007, Wiklund and Shepherd, 2009).

3.4.2 Role of Dynamic Capabilities in the Process of Resource Value Creation

The research findings so far suggest that DCs can be a source of value creation as it allows superior 'Sensing', 'Learning', 'Integrating' and 'Coordinating' of resources. Moreover, findings suggest that the higher the firm`s DCs - its **Sensing, Learning, Integrating** and **Coordinating capacities** - the higher the amount of new RRs. Accordingly, firms that have developed higher Sensing, Learning, Integrating and Coordinating capacities, are more likely to successfully develop new RRs. However, it was not yet clearly specified what the specific role of DCs is in this process of resource value creation.

Based on the DC framework and the conceptualisation of the four DCs, this chapter elaborates on their specific role in the process of resource value creation. Doing so, the following chapter aims to specify the above hypotheses H2, H3, H4, and H5, in order to explain the interrelations between DCs and RR in firms in more detail, clarifying the role of DCs in the development of RRs in firms. Following Ambrosini and Bowman`s (2009) call for research investigating how DCs operate towards performance outcomes, the aim is to specify the role and effect of each single capacity in relation to their relevant performance and contextual factors. Therewith, this chapter aims to clarify the linkage between building the resource base for RR (potential value) and new RRs in firms (realised value).

3.4.2.1 Sensing and Learning as Potential Building Dynamic Capabilities

Following Sanchez and Heene (1997, p. 307) competence building is "any process by which a firm achieves qualitative changes in its existing stocks of assets", while competence leveraging is "a process through which a firm applies its existing competences to current or new market opportunities in ways that do not require qualitative changes in the firm's assets or capabilities."

Taking up these conceptual thoughts, this research assumes that the firm`s Sensing and Learning capacities work on towards **building the potential value** of a firm`s resources (in terms of its quality and diversity) by continuously renewing and reconfiguring the firm`s resource base with new resources and knowledge. Accordingly, it is especially the Sensing and Learning capacity that "enables the firm continually to refresh the resource stock so that the firm can continue to 'hit a moving target'" (Ambrosini and Bowman 2009, p. 48). Thus, a firms Sensing capacity and Learning capacity is suggested to contribute to build a rich and diverse resource base, the "raw material" for RR. More specifically, Sensing and Learning capacities are positively related to **resource diversity**, leading to a higher accumulation of new Market and Technological Knowledge (*knowledge breadth*). Sensing and Learning capacity is also positively related to **resource quality**, leading to a higher Market and Technological Knowledge depth. In other words, a high Sensing and Learning capacity is positively associated with a high diversity and quality of the resource base in regard to Market and Technological Knowledge (H2a/H3a), which in term is positively associated with RR in firms (H2c/H3c).

More precisely, while a high Sensing capacity is positively associated with a high diversity and quality of the Market Knowledge, as it is leading to a higher Market Knowledge breadth and depth, a high Learning capacity is positively related to both, broad and deep Market and Technological Knowledge. Thus, Sensing and Learning capacity are positively related to a high potential value of the resource base for RR.

→ **Mediating Role of the Resource Base between Sensing and Leaning capacity and RR**

Viewed differently, Sensing and Learning capacity leads to an increased performance in regard to RR. However, as not all firms that have developed high DCs are subsequently high performing in achieving RR, this relation is expected to be fully and positively mediated by Market and Technological Knowledge. Rather more it is theorised that "some other variable is needed to explain the reason for the inconsistent relationship between IV [independent variable] and DV [dependent variable]" (Gaskin, 2012d). It is suggested that Market and Technological Knowledge act as such a mediator and are regarded as key variables that fully and positively mediates the relationship between Sensing and Learning capacity and RR. The relationship between Sensing and Learning capabilities and RRs in firms is fully mediated by the (resulting) quality of resource base (the potential value of the resource base). Hence H2 and H3 can be formulated more precisely through the following hypotheses:

H2a/H2b/H2c: *The effect of Sensing capacity on RR <u>is positively and fully mediated</u> by the diversity and quality of Market and Technology Knowledge.*

H3a/H3b/H3c*: The effect of Learning capacity on RR <u>is positively and fully mediated</u> by the diversity and quality of Market and Technology Knowledge*.

3.4.2.2 Integrating and Coordinating as Value Realising Dynamic Capabilities

On the other hand, it is expected that the Integrating and Coordinating capacity work on towards *exploiting the value potential* of the resource base by transforming it into new RRs and thus help to realise the value potential through RRs. The underlying assumption is, that Sensing and Learning *per se* cannot ensure superior innovation performance (Lichtenthaler, 2012, Helfat and Peteraf, 2009). Only when firms possess the necessary capabilities to integrate and reconfigure the resources into new innovative resource bundles, and to coordinate and deploy tasks, activities and resources in these newly developed resource bundles, value is created. Hence, while Sensing and Learning provide the basis, the resource leveraging process is established through a firm`s Integrating and Coordinating capacities.

Thus, the Integrating and Coordinating capabilities help to *realise* the value creation potential of the resource base through the development of new RRs. In other words, given the same assessment of the potential value of a firm`s resources base for RR (in terms of its quality and diversity), firms that have developed a higher Integrating and Coordinating capacity are more likely to develop new RRs, and therefore are able to realise more of the value potential of the resource base than firms that have fewer capacities.

→ **Moderating Role of Integrating and Coordinating capacity between Resource Base and RR**

In other words, Integrating and Coordinating capacities moderate the relationship between Technological Knowledge (breadth and depth) and RR. Said differently, Integrating and Coordinating capacity strengthens the positive relationship between Technological Knowledge and RR. A high Integrating and Coordinating capacity is positively associated with RR in firms as it is moderating the relationship between the resource base and RR in firm. The effect of the knowledge base on RR is moderated by the Integrating and Coordinating capacity, in such a way that a low Integrating and Coordinating capacity decreases the amount of new RR while a high Integrating and Coordinating capacity increases the amount of new RR in firms. The higher a firm`s Integrating and Coordinating capacity, the more positive the relationship between (i) the resource base and (ii) the amount of new RRs in firms. In other words Integrating and Coordinating capacity (positively) moderates the positive effect of Technological Knowledge on RR, such that if firms have low Integrating and Coordinating capacity the effect is weaker. Hence, it is suggested that both these effects will affect the ability to develop new RRs.

***H4a:** A high Integrating capacity is positively associated with RR in firms as it is moderating the relationship between Technological Knowledge and RR in firms.*

***H5a:** A high Coordinating capacity is positively associated with RR in firms as it is moderating the relationship between Technological Knowledge and RR in firms.*

3.4.2.3 Potential Building and Value Realising Dynamic Capabilities and their Role in the Process of Resource Value Creation

Summarising the above findings, regarding their relationship to the performance outcome of new RRs, it is assumed that two different types of DCs can be distinguished: **Potential Building** and **Value Realising DCs**[11], both components have different effects and "working modes" towards RR in firms:

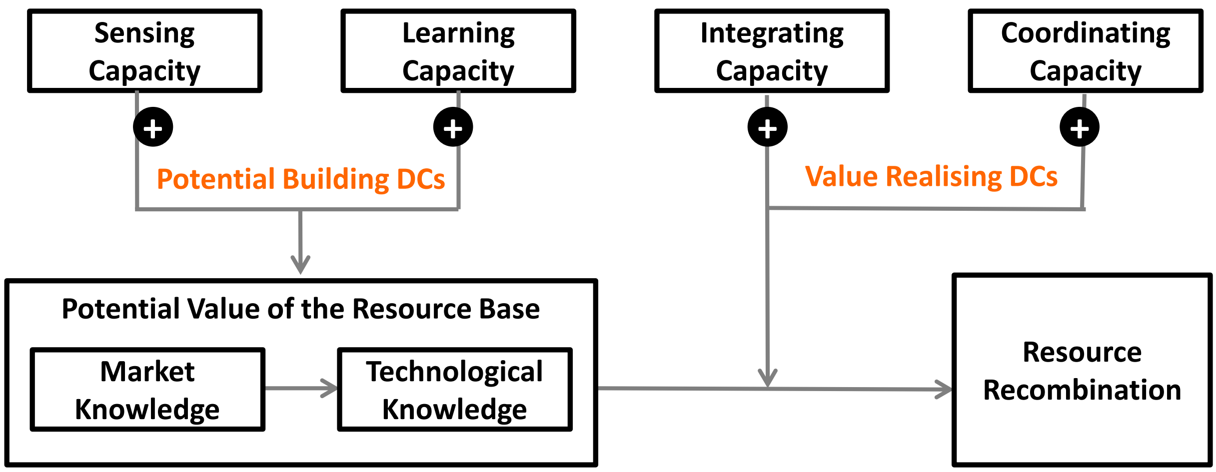
- The Sensing and Learning capacities are necessary for building the potential value of the resources for RR, and thus can be referred to as *Potential Building DCs*. They are directed towards *exploration* of new opportunities in the environment and the building of a rich and diverse resource base.

[11] This differentiation is related to Zahra and George`s (2006) re-conceptualisation of the ACAP construct, just as the ACAP construct can be distinguished in two sub-sets, namely PACAP and RACAP, the DC construct can be differentiate in two main types of DCs in regard to RR.

- The Integrating and Coordinating capacities are necessary for the value potential of the resource base to become realised by creating, implementing and exploiting new innovative RRs, and thus can be referred to as *Value Realising DCs*. They are directed towards the *exploitation* of the existing resources through the development of new RRs.

Figure 3.4 gives a graphical illustration of the proposed causal relationships as outlined above.

Figure 3.4 Potential Building and Value Realising Dynamic Capabilities



Source: own illustration

Taken as a whole, this research proposes that the higher the firm`s DCs - **its Sensing, Learning, Integrating and Coordinating capacities** - the better the firm will be at *building* and *exploiting* the value potential of the resource base, resulting in a higher amount of new RRs. The detailed view showed that firms having developed higher Sensing and Learning capacities are more likely to *build* the potential value of the resource base, while firm`s having developed higher Integrating and Coordinating capacities are more likely to *exploit* and *thus realise* the potential value of their resource base, and therefore are more likely to successfully develop new RRs.

3.5 Framework Conditions for the Development of Dynamic Capabilities

Having specified the DC framework allows in a subsequent step to have a closer look on the framework conditions for the development of DCs, in order to examine how DCs can be enhanced by identifying their antecedents. The underlying assumption is, that while DCs reside in the organisational processes and routines (as described in depth and detail in the DC framework presented previously), they are supposed to being impacted by the organisational framework conditions, which the organisation has created to manage its business activities (Teece, 2007).

Hence, it is suggested that the evolution of DCs is influenced by a range of organisational factors. Based on these preliminary considerations, the following section specifies Proposition 3 and further elaborates the framework conditions for the development of DCs.

Proposition 3: Entrepreneurial Orientation and Networking Orientation act as antecedents for the development of a firm`s DCs.

Current literature shows growing interest in investigating the antecedents that are suggested to influence the development of DCs (e.g. Madsen, 2010, Hawass, 2010). Accordingly, a wide range of different antecedents residing at individual-, firm- and network-levels (Rothaermel and Hess, 2007) have been proposed in the literature and are being discussed as relevant determinants for the development of DCs (e.g. Teece, 2007, Zollo and Winter, 2002, Eisenhardt and Martin, 2000). However, up to today only scarce empirical research exists exploring the conditions and processes inside and outside the organisations that lead to DCs (Hawass, 2010). Still it is a quite unspecific picture that has been drawn, concentrating on multiple factors of various different levels and from different perspectives. Hence, far too little attention has been paid to empirical investigate the influencing factors for the development of DCs (Ambrosini and Bowman, 2009), especially those that might reside in the underling strategic orientation of the firm.

To address this research gap, the following section set out to examine the determinants of the firm`s DC from a multilevel organisational perspective. While this research agrees with previous research suggesting that antecedents to DCs can be found at individual-, firm-, and network-levels (e.g. Zollo and Winter, 2002, Rothearmel and Hess, 2007, Eisenhardt and Martin, 2000, Hawass, 2010), and that firms can draw on antecedents across different levels to build DCs (Rothearmel and Hess, 2007), this study refrains from investigating the individual-level antecedents of DCs. Instead, the following chapter specifies the framework conditions for the development of DCs, looking at **Entrepreneurial Orientation** and **Networking Orientation** identified as important antecedents for DCs, and thus focussing on firm- and network-level antecedents. While a wide range of literature exists concerning firm`s strategic orientation, based on a thorough review of literature from the strategic management and entrepreneurship spectrum, Entrepreneurial Orientation and Networking Orientation could been identified as the two antecedents relevant for this study.

By focusing on Entrepreneurial Orientation and Networking Orientation as antecedents of DCs, this study responds to prior calls for research that explicates firm-related determinants that may explain the development of DCs (Zahra and Wiklund, 2002). Therewith findings add to theory by improving the understanding of the antecedents necessary for DCs and respectively RR in firms to occur.

3.5.1 Entrepreneurial Orientation

Entrepreneurial Orientation (EO) refers to a firm's strategic orientation, which characterises the firm`s entrepreneurial behaviour by capturing specific entrepreneurial aspects of decision-making styles, methods, and practices (Lumpkin and Dess, 1996, Wiklund and Shepherd, 2003), and commonly is regarded as a combination of *Innovativeness*, *Proactiveness*, and *Risk-taking* (e.g., Miller, 1983, Covin and Selvin, 1989, Zahra 1991, Wiklund, 1999, Baker and Sinkula, 2009). This research adopts Lunpkin and Dess`s (1996) definitions of the three dimensions of EO:

First, *Innovativeness* refers to the firm`s tendency or willingness to engage in and support new ideas, novelty, experimentation, and creative processes, which may result in new products, services, or technological processes (Lumkin and Dess, 1996). Thus, it is regarded to "reflect a basic willingness to diverge from the status quo and embrace new ideas" (Baker and Sinkula, 2009, p. 447). Second, *Proactiveness* refers to the firm`s attitude towards taking initiatives by anticipating and pursuing new opportunities and by participating in emerging markets (Lumkin and Dess, 1996). Third, *Risk-taking* is reflected by "the willingness of managers to commit a large percentage of a firm's resources to new projects and to incur heavy debt in the pursuit of opportunity" (Baker and Sinkula, 2009, p. 447, referring to Lumpkin and Dess 1996).

There is a consistent claim in literature that management practice and entrepreneurial activities can facilitate RRs in firms (e.g. Brown and Eisenhardt, 1998, Eisenhardt and Martin, 2000, Zahra and Wiklund, 2002, Wiklund et al., 2002). Besides DCs, hence, the firm`s EO is regarded as important determinant for the creation of new combinations of resources (Penrose, 1959, Brown and Eisenhardt, 1998, Eisenhardt and Martin, 2000, Zahra and Wiklund, 2002, Madsen, 2010), as a result "this provides a clear and close association between entrepreneurship and resource based theory, especially dynamic capabilities" (Madsen, 2010, p. 233).

Theory and empirical findings reveal that entrepreneurial flexibility of combining existing resources in new ways in order to find innovative RRs, will consequently lead to new products and services in the market (Wiklund et al., 2002). Thus entrepreneurial management practices are proposed to result in organisational change activities, as they are leading to an increased understanding of the establishment and utilisation of firm`s resources (Madsen, 2010). Consistent with this view, a variety of studies gave evidence to the perceived role of EO as key factor for improving a firm`s performance outcomes (Covin and Slevin, 1989, Lumpkin and Dess, 1996, Wiklund, 1999, Madsen, 2007, 2010). Investigating the effect of entrepreneurship in management practice on RR in firms, Wiklund at al. (2002) confirmed a positive, direct effect of entrepreneurial management practices (specifically entrepreneurial culture, growth orientation, and strategic orientation, all representing over-arching aspects of EO) on RR, however their findings also revealed entrepreneurial management practices to only have modest explanatory power with respect to RR (Adj. R^2 = 0.16, resp. 0.17) (Wiklund et al., 2002, p. 1515). Following Wiklund et al. (2002, p. 1510), one explanation could be that “the specific vehicles through which a vision and culture of entrepreneurship are translated into effective resource recombination” have not been investigated, neither been measured empirically.

Interestingly, while a vast variety of studies assume a direct linkage between EO and RR, resp. firm performance, there is a scarcity of literature investigating the association between EO and DCs (e.g. Madsen, 2010). Those theoretical works that were found suggest a positive relationship (Madsen, 2010), while empirical evidence is still lacking. Assuming that both concepts EO and DCs are somewhat attached to how the firm builds and exploits internal and external resources and thus creates new RRs, the aim of this research is to elaborate the relationship between EO, DCs and RR.

Based on the original thoughts by Madsen (2010) this research assumes that while the EO primarily reflects the *willingness* or *attitude* of the firm concerning the engagement in entrepreneurial behaviour (Wiklund, 1998), the *DCs* refer to the *activities* itself which build, develop, integrate and reconfigure internal and external resources. Accordingly, EO and DCs emerge at different levels. While EO refers to “a firm`s willingness to be innovative, proactive and engage in risk-taking behaviour in order to achieve its strategic goal” (Madsen, 2010, p. 236), it is proposed to operate on a more superior strategic level than DCs, which in turn are proposed to “include operational activities which are essentially concerned with the development of the organisation and carrying out diverse operations (for example, product development, alliance building, strategic decision-making, etc.)” (Madsen, 2010, p. 236).

Given this delineation of the two concepts, it emerges that while both concepts have a number of common denominators, they are theoretically and empirically distinct (Madsen, 2010). Thus a firm`s EO, hence a culture of change and transformation, can be regarded as a necessary framework condition and “should be embedded within the social fabric of organization” (Hawass, 2010, p. 410) to facilitate the actual recombinant activities (implemented through Sensing, Learning, Coordinating and Integrating Capacities) for RR. Subsequently EO is proposed to support the development of the firm`s DCs, in such a way that firms having established a higher EO are more likely to have a certain tendency to develop higher DCs over time. Therefore EO is suggested to act as antecedent of DC. Consequently, it can be argued that there is a positive association between EO and DCs, leading to the following hypothesis:

H6: *A higher degree of Entrepreneurial Orientation is positively associated with the development of the firm`s DCs.*

A detailed description of how the firm`s EO is proposed to affect the firms Sensing, Learning, Integrating and Coordinating capacities, capacities, along with the respective hypotheses H6a, H6b, H6c, H6d, is presented in Appendix 3.2.

3.5.2 Networking Orientation

Networking Orientation (NO) in this research is conceptualised as "the extent to which a firm's business strategy stresses effective and efficient location of network partners, management of network relationships, and improvement of network performance" (Mu and Di Benedetto, 2011, p. 341). A firm`s NO thus captures the firm`s strategic orientation towards collaborating with external entities, i.e. its suppliers, customers, universities or research institutions, and can be described as the firm`s openness to external sources through alliances, networks, and partnerships (Dahlander and Gann, 2010). The construct is based on the perception that firms, which are accessible for and open to external partners, are suggested to be more capable of drawing new ideas and resources from these exogenous sources to enlarge their own pool of market opportunities, complementary assets, and external resources available to the firm (Mu and Di Benedetto, 2011). Thus, "the importance of networking orientation lies in that firms can employ networking as a means to exploit knowledge, take advantage of established and new technologies and products, and pool resources through their relationships with various partners" (Mu and Di Benedetto, 2011, p. 352).

There is a consistent claim in literature that interorganisational collaboration can serve as significant source of competitive advantages by bringing in new opportunities and resources (McEvily and Zaheer, 1999, Gulati, 1999, Phan and Peridis, 2000, Peng and Delios, 2006, Mathews, 2002, Isobe et al., 2008). Accordingly, a variety of empirical studies confirmed a positive relationship between inter-organisational linkages, technological development and firm performance (Powell et al., 1996, Henderson and Cockburn, 1994, Baum et al., 2000, Isobe et al., 2008). Whilst it is generally agreed that "inter-firm collaborations are not simply a means to compensate for the lack of internal skills, nor should they be viewed as a series of discrete transactions" (Powell et al., 1996, p. 119), to a greater degree strong network ties are suggested to allow firms strengthen and develop their internal competence and resource position through collaboration (Isobe et al., 2008). Consistently, Isobe et al. (2008) found interfirm collaboration to play an essential role for the development of the firm`s reconfiguration capability by means of allowing external learning, which supplements previous research findings emphasising the crucial role of interorganisational networks for interorganisational learning and firm performance (Lane and Lubatkin, 1998, Lee et al., 2001, Rothaermel, 2001).

Given these research findings, a firm`s NO, which captures the firm`s tendency to embed close interactions with external entities in their core business, is regarded as an important determinant for resource value creation in firms. This is due to the fact that firms with high NO assign value to "purposefully create and improve the ability to orchestrate its networks to tap into complementary resources that are beneficial to new product commercialization" (Mu and Di Benedetto, 2011, p. 341). Also, findings from product innovation, marketing and network relationship management give evidence that firms with a higher NO attach superior value at searching, managing, and leveraging network relationships (Mu and Di Benedetto, 2012). Likewise EO, which described the firms *willingness* or *attitude* to engage in entrepreneurial activities, the firm`s NO thus describes the firm`s *willingness* or *attitude* towards engaging in interfirm collaborations.

Research from different disciplines showed evidence for networking activities and inter-organisational linkages to act as a means for creating value in firms (Isobe et al., 2008, Lorenzoni and Lipparini, 1999, Lee et al., 2001, Rothaermel, 2001). Traditionally, researchers assume a direct effect of NO and firm performance, without asking how an enhanced NO is leading to superior performance. However, literature also claims that firm`s must have the ability to orchestrate their networks to extract value (Mu and Di Benedetto, 2012). Despite this awareness, literature on network theory focuses on network structure and outcomes rather than examining the internal processes and capabilities a firm needs for managing, building and leveraging the benefits from its networks to create competitive advantages (Mu and Di Benedetto, 2012). Therefore this research sets out to investigate the relationship between NO and DCs towards building new RR, as both concepts are somewhat attached to how the firm builds and exploits internal and external resources and thus creates new RRs.

It is assumed that firms with an increased NO should have an increased ability to purposefully create, extend and modify its resource configurations (Mu and Di Benedetto, 2012) by improving its Sensing, Learning and Integrating and Coordinating capacities. Hence, this study does not only investigate the direct effect of NO on RR, but moreover sets out to investigate if a high Sensing, Learning, Integrating and Coordinating capacity respectively mediates the effect of NO on RR in firms.

H7: *A high degree of Networking Orientation is positively associated with the development of a firm`s DCs.*

A more detailed description of how the firm`s NO is proposed to affect the firms Sensing, Learning, Integrating and Coordinating capacities, along with the respective hypotheses H7a, H7b, H7c, H7d, is presented in Appendix 3.3.

The hypotheses, as outlines above, add to theory by improving the understanding of the antecedents of DCs, necessary for RR to occur, and therewith contribute to conceptualise the influencing factors of RRs within a model. The conceptual model, summarising and representing the proposed relationships discussed in this chapter, is presented in the following.

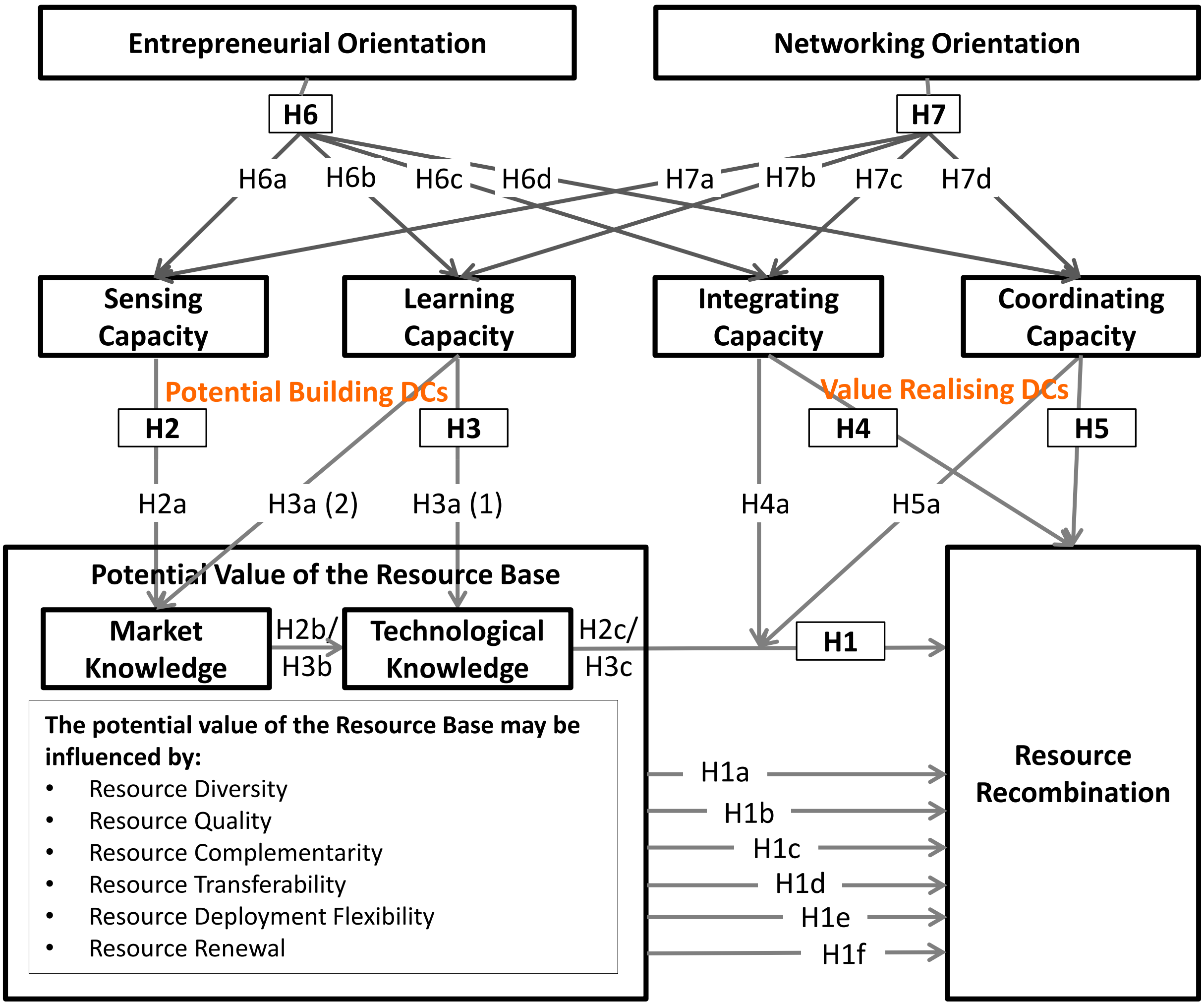
3.6 The Preliminary Conceptual Model and Hypotheses

3.6.1 The Preliminary Conceptual Model

Comprising this research`s arguments and presenting the theoretical arguments of this research the preliminary conceptual model and its respective hypotheses are presented in the following. Figure 3.5 gives a graphical illustration of the conceptual model and expected causal relationships between the constructs relevant for this study to be tested empirically in a subsequent research step.

In brief, the conceptual model presented in Figure 3.5 shows the expected causal dependencies between the DCs, the resource base, and the outcome variable of RR. The conceptual model shows the four DCs, their interrelationships and impacts on performance outcome variable (RRs), as well as their effects on the resource base.

Figure 3.5 Conceptual Model based on the Literature Review



Source: own illustration

Doing so, the model illustrates the role of DCs in the process of RR in firms. While the Sensing and Learning capacity are expected to work towards *building* the resource base relevant for RRs, the Integrating and Coordinating capacity are working towards *exploiting* the resources base by building new innovative RRs, and therefore act as a moderator between the resource base (endogenous variable ξ) and RR in firms as outcome (the exogenous variables η).

Thus, it is suggested that the **realised value through RRs** is a function of the **potential value of the resource base** (measured by means of Market and Technology Knowledge breadth and depth) and **the DCs** (Sensing, Learning, Integrating, Coordinating capacity) relevant for the process of RR.

Hence, the greater emphasis the firm puts on the development of these specific DCs the more it first *builds*, and second *realises* the potential value of the resource base by successfully developing new RRs. Hence, both the resource base and the DCs of the firm are seen as important factors that influence RR in firms. A logical effect of this would be that the relative importance and value of the firm`s resource and DCs, respectively, is very different in various environments, depending on the dynamics.

Moreover, the conceptual model shows the expected causal relationships between Entrepreneurial and Networking Orientation and the firm`s DCs. Both EO and NO are regarded as important antecedents (at the firm- and network-level) for the development of DCs. While EO (respectively NO), reflects the *willingness* or *attitude* of the firm concerning the engagement in entrepreneurial behaviour (networking activities, respectively), the DCs refer to the *activities* (processes and routines) itself which build, develop, integrate and reconfigure internal and external resources. A summary of the corresponding hypotheses, discussed in depth and detail in this chapter, is presented in the following section.

3.6.2 Hypotheses

The conceptual model and hypotheses presented in this chapter provide the conceptual foundation of RR in firms and opens paths for the subsequent qualitative and quantitative analyses in order to test the developed theory regarding the effects of a firm`s DCs and resource endowments on RR, respectively value creation in firms. For further analysis, the hypotheses developed in this chapter based on the literature review are summarised in Table 3.2 to 3.7. The hypotheses are further tested by means of qualitative and quantitative research undertaken and described in the following chapter 4 and 5, respectively.

A) Interrelations between the Resource Base and RR

Table 3.2 Interrelations between the Resource Base and RR

Hyp.	Independent Variable	Dependent Variable	Predicted Relationship
	Potential Value of the Resource Base	RR	positive
H1	Technological Knowledge (Techno. Knowl. Breadth and Depth)	RR	positive
H1(1)	Market Knowledge (Market Knowl. Breadth and Depth)	RR (through Technological Knowledge)	positive (indirect)

While controlling for: Characteristics of the Resource Base and RR

H1a	Knowledge Breadth	RR	positive
H1b	Knowledge Depth	RR	positive
H1c	Knowledge Complementarity	RR	positive
H1d	Knowledge Tacitness	RR	negative
H1e	Knowledge Context Specificy	RR	negative
H1f	Knowledge Origin	RR	positive

B) Interrelations between DCs and RR (through the Resource Base)

Table 3.3 Interrelations between DCs and RR (through the Resource Base)

Hyp.	Independent Variable	Dependent Variable	Predicted Relationship
	Overall DC	RR	positive
H2	Sensing Capacity	RR (through Market and Technological Knowledge)	positive (indirect)
H3	Learning Capacity	RR (through Market and Technological Knowledge)	positive (indirect)
H4	Integrating Capacity	RR	positive
H5	Coordinating Capacity	RR	positive

C) Role of DCs in the Process of Resource Value Creation

(I) Sensing and Learning as Potential Building DCs in the process of Resource Value Creation

Table 3.4 Mediating Role of the Resource Base between Potential Building DCs and RR

Hyp.	Independent Variable	Mediator	Dependent Variable	Predicted Relationship
	Potential Building DCs	Potential Value of the RB	RR	positively mediating
H2a H2b H2c	Sensing Capacity	Market Knowledge and Technological Knowledge	RR	positively mediating
H3a H3b H3c	Learning Capacity	Market Knowledge and/or Technological Knowledge	RR	positively mediating

(II) Integrating and Coordinating as Value Realising DCs in the process of Resource Value Creation

Table 3.5 Moderating Role of Value Realising DCs between the Resource Base and RR

Hyp.	Independent Variable	Moderator	Dependent Variable	Predicted Relationship
	Potential Value of Resource Base	Value Realising DCs	RR	positively moderating
H4a	Technological Knowledge	Integrating Capacity	RR	positively moderating
H5a	Technological Knowledge	Coordinating Capacity	RR	positively moderating

D) Entrepreneurial and Networking Orientation as Antecedents for DCs

Table 3.6 Entrepreneurial Orientation as Antecedent for DCs

Hyp.	Independent Variable	Dependent Variable	Predicted Relationship
H6	Entrepreneurial Orientation	Dynamic Capabilities	positive
H6a	Entrepreneurial Orientation	Sensing Capacity	positive
H6b	Entrepreneurial Orientation	Learning Capacity	positive
H6c	Entrepreneurial Orientation	Integrating Capacity	positive
H6d	Entrepreneurial Orientation	Coordinating Capacity	positive

Table 3.7 Networking Orientation as Antecedent for DCs

Hyp.	Independent Variable	Dependent Variable	Predicted Relationship
H7	Networking Orientation	Dynamic Capabilities	positive
H7a	Networking Orientation	Sensing Capacity	positive
H7b	Networking Orientation	Learning Capacity	positive
H7c	Networking Orientation	Integrating Capacity	positive
H7d	Networking Orientation	Coordinating Capacity	positive

3.7 Chapter Summary

To provide a basis for the conceptual development and empirical investigation of RR in firms from a DC perspective, this chapter examined the theoretical framework, the determinants and framework conditions of the concept of RR and outlined the research`s arguments and related hypotheses. The aim was to bring clarity to the notion of DCs, their role and effects towards RRs in firms.

Starting with an introduction of the current knowledge of resource value creation in firms from the DC perspective, including the differentiation of the *potential* and *realised value* of the resources, the preliminary considerations of this research were presented, forming the theoretical base of this study. Based on these preliminary considerations, first the characteristics of the resource base were discussed in respect to their perceived role in forming the potential value of the resource base for RR. This was followed by the presentation of the DC framework, providing a detailed elaboration of the four DCs: *Sensing capacity, Learning capacity, Integrating capacity* and *Coordinating capacity*, their underlying processes and activities. Based on the delineation of the four DCs, moreover, their role in the process of resource value creation was further specified. This was followed by an investigation of the framework conditions for the development of DCs, whereby based on existing literature from the resource and competence based theory the firm`s *Entrepreneurial Orientation* and *Networking Orientation* could be identified and were discussed as important antecedents of DCs. The chapter concluded with the presentation of the conceptual model for this research, presenting the theoretical linkages between the studies` constructs of interest and culminating into a subset of studies` hypotheses, which have to be tested empirically in the subsequent qualitative and quantitative research steps.

By doing so, this chapter merged the understanding of the RBV and DC perspective, outlining the concept of RRs by investigating the relation between the resource base, DCs, and its performance outcomes RR. Therewith this chapter addressed existing shortcomings in the DC literature, where there is a crucial need to better understand the interrelationship between capabilities, the resource base of the firm, and innovation in the form of RRs. With the presentation of the DC framework, this chapter allowed a clarification of the DC constructs, extending the focus of current literature by investigating the organisational processes and activities underlying each DCs. The DC framework thereby brings clarity in the notion of DCs, moreover, it opens avenues for empirical research. Additionally, given the enhanced understanding of the four DCs, the conceptual model presented here allowed to delineate key differences in their role and effects towards building RRs. One result is that regarding their relationship to performance outcome of new RRs, two different types of DCs are proposed to be distinguished*: Potential Building* and *Value Realising DCs*.

Thus, with the conceptual model presented in this chapter, a more precise understanding of the firm`s DCs has been given, shedding light on their role and effects towards developing new RRs in firms and investigating their antecedents. Therewith, this chapter opens up the black box of RR in firms and offers strategic pathways of how firms can strategically foster the recombination of existing resources as an important source for continuous innovation generation.

The conceptual model and the hypotheses presented in this chapter have provided the conceptual foundation for a subsequent empirical investigation, where the conceptual model has to be tested, refined, and validated. The subsequent research step thus is to qualitatively and quantitatively test the model and hypotheses presented here in order to empirically validate the conceptual model and establish it as a theoretical robust and validated concept for strategic management and thereby to contribute to an advanced understanding of DCs and RR in firms. Thereby this research addresses Ambrosini and Bowmans` (2009, p. 45 f.) directions to further research, firstly to "clarify some of the concepts that seem to be open to differing interpretations", second "establishing dynamic capabilities as a theoretical well-founded construct", and third "to embark on appropriate empirical research". Correspondingly, the following chapter first presents the research design and qualitative research step undertaken to refine the theoretical model for further quantitative testing in the subsequent research step, where the conceptual model and hypotheses are tested empirically.

Chapter 4: Qualitative Research: Model and Hypotheses Refinement

4.1 Introduction

Despite the active discussion of firms policies to foster innovation generation, few researchers have engaged in analysing RRs, their characteristics and key drivers, be it from a management or a research perspective. On the other hand, conceptual elaborations have been made within the DC literature, and "the dynamic capability framework is drawing support and increased validity by researchers, empirical studies of dynamic capabilities remain relatively rare" (Pablo et al. 2007, p. 690). Scattered research has emerged in recent years stating the increased relevance of DCs in firms and conceptually investigating the notion of DCs, hitherto "we have little theoretical or empirical evidence on which to base any suggestions as to how dynamic capabilities can be deliberately built" (Ambrosini and Bowman, 2009, p. 44). Today there emerges an increasing array of conceptual elaborations about DCs, however empirical support is still limited (Ambrosini and Bowman, 2009).

To provide a basis for the conceptual development and empirical investigation of RR in firms from a DC perspective, the previous chapter examined the theoretical framework of the RR concept, investigated the DC of the firm and established their antecedents and interrelationships towards building RR. Hence, this chapter allowed a clarification of the constructs and provided an outline of the preliminary conceptual model based on literature, therewith the basis for an empirical investigation.

In order to elaborate on these theoretical and conceptual findings and to transfer the preliminary conceptual framework into a generic model – one that is not only theoretically well founded but also empirically tested – this research conducted a mixed method research strategy, entailing both a qualitative and quantitative research steps. In a first step, exploratory qualitative research was conducted in order to further specify the preliminary conceptual model and the hypotheses derived from the literature review. The refined conceptual model and the related hypotheses were thereafter empirically tested in the second, quantitative research step.

This chapter describes and justifies the *research design* and *methodology* and outlines the research findings of the first, qualitative research step. The first section of this chapter starts with an elaboration of the research design. It involves an introduction and discussion of the mixed-method research strategy and further illustrates the research methods applied in this research.

Following the introduction and discussion of the general research design, the second section of this chapter addresses the research methods applied for the first, qualitative research step in more detail. Within this section, the two qualitative research methods applied, namely a *discussion forum* and *participant observation* as part of an intercultural innovation workshop, and a subsequent *series of in-depth interviews* with industrial representatives, are outlined and discussed.

Thereafter, in the last section of this chapter, based on a structured content analysis of the *discussion forum* and the *in-depth interviews*, the results from the qualitative research are presented and discussed. Drawing on the key finding from the qualitative research step, minor adjustments of the conceptual model, that shows the 4 DCs, their interrelationships and impacts on performance outcome variable (RRs), as well as their effects on the resource base, are presented.

4.2 Research Design

The following section outlines the **research design**, which describes "the plan or proposal to conduct research" (Creswell, 2009, p.5) and involves the intersection of philosophical worldview, research strategies and specific methods of data collection, analyses, and interpretation. In order to test the developed theory and to contribute to the establishment of the concepts of RR and DCs as a well-founded and robustly defendable area of research, the research strategy and methods applied for this research were based on previous studies in the related fields (e.g. Plewa, 2010). The following sections elaborate on the **research strategies** and subsequently the **research methods** used in this research, which guides the procedures of data collection and analysis.

4.2.1 Research Strategy

Integrating both qualitative and quantitative research methods, this research adapted a **mixed-method research strategy**. More precisely, a two-stage approach was applied, where a first phase of qualitative data collection and analysis was followed by a second phase of quantitative data collection and analysis. The mixed-method approach is also referred to in literature as a **sequential exploratory strategy** (Creswell, 2009, p.211). Hence, the research strategy applied follows Carson and Coviello's (1996) call for multi-method approaches to achieve highly valuable findings. Following Plewa (2010) this goes in line with Edmonson and McManus' (2007) review on methodological fit in management field research, where they propose that qualitative and quantitative methods should be combined when the aim is either to increase validity of new measures trough triangulation or to generate greater understanding of the methods underlying quantitative results in at least partially new territory. The research strategy applied in this study can be further classified according to the different research types that are referred to in literature as *exploratory, descriptive,* and *explanatory* research (Kinnear et al., 1993). As outlined in the following, this PhD research combines all three of these research types.

Exploratory research is generally applied to investigate unknown and complex phenomena (e.g. Plewa, 2010). As a means for exploring and understanding these phenomena, exploratory research builds the basis for further research, which often is found to be applied subsequently in order to provide evidence of the exploratory findings (Zikmund, 2003). In light of the novelty of the denotation of

DCs and the perception of RR as a source of wealth creation in strategic management research, exploratory qualitative research was conducted to refine the conceptual model and related hypotheses derived from the literature review before conducting any further quantitative analysis.

The first exploratory research step was justified based on the following aspects:

First, while the concept of RR has been recognised in literature as source for wealth creation, still little is known about the process how firms recombine their resources (Galunic and Rodan, 1998). The introduction of the DC perspective on the concept of RR in firms is new. This research goes beyond traditional approaches to understand competitive advantages. Furthermore, little is known about how a possible framework to measure RR in firms could be designed.

Second, while a wide spectrum of different capabilities has been denoted under the "umbrella of DCs" and an array of different processes and routines has been assumed to provide the microfoundations of DCs (e.g. Teece, 2007; Eisenhardt and Martin, 2000), there is still a lack of a consistent definition of a firm`s DCs. At the same time, as existing studies mainly describe DCs as "broad organizational processes", they "do not delve into the detailed, micro mechanisms of how these capabilities are deployed and 'work'"(Ambrosini and Bowman 2009, p. 37). To date there is still a poor understanding of the construct of DC and its existence is often assumed without specifying their exact components (Galunic and Eisenhardt, 2001, Ambrosini and Bowman, 2009), what makes it difficult to quantitatively approach the concept without a first exploratory investigation. Hence, one further aim of the exploratory research step was to first "identify discrete processes inside the firm that can be unambiguously causally linked to resource creation" (Ambrosini and Bowman 2009, p. 44), and therewith to establish DCs as a theoretically well-founded construct before any further quantitative research was undertaken. Doing so, this research followed Lockett and Thompson (2001, p. 743) suggestion to use a plurality of methods, as "it may be necessary to sacrifice some of the generality of quantitative investigations for a more qualitative attention to the detail".

Third, despite an increasing acknowledgement of DCs in the literature, the sparse knowledge that existent in the area of how these capabilities can be build and what influence they have on specific performance outcomes (e.g. RR), is limited to single case studies, focused only on one level of analysis, or is limited to a specific business segment or industry (Rothaermel and Hess, 2007).

In summary, given the complex research context of RRs in firms, coupled with very limited understanding of the DCs, its role and effects, explorative research methods were deemed most valuable for the investigation of RRs in firms from a DC perspective, as they allowed the development of an in-depth understanding of concepts, situations and behaviors (Flint et al., 2002). Hence, as the DC construct, its antecedents and the RR outcomes to be tested in this study are of a complex and versatile nature, an exploratory investigation of these constructs was considered crucial for the validity of findings deriving from quantitative research.

Based on the exploratory findings of the first, qualitative research step, descriptive and explanatory research was conducted in a second, quantitative research step in order to empirically test the conceptual model. **Descriptive research** is generally used to describe and determine characteristics and frequencies of a phenomenon involved in a study (Zikmund, 2003). While descriptive research can be used to predict associations between variables, it is not appropriate to explain patterns within data (Ticehurst and Veal, 1999, Kinnear et al., 1993). Thus **explanatory research,** also referred to as confirmatory or causal research, in addition was used in this study to test the predicted causal relationships in data (Kinnear et al., 1993, Zikmund, 2003).

This second, quantitative research step was justified based on the following aspects:

While a number of researchers have taken exploratory research approaches to DCs and RR, leading to a growing amount of normative and conceptual findings (Teece at al., 1997, Teece 2007, Eisenhardt and Martin 2000, Kogut and Zander 1992), these findings have to be aligned, operationalised and tested empirically. Extant empirical research is either limited only to specific industry sectors or approaches only a partial picture of the multilevel effects associated with the various mechanisms firms use to recombine their resources. A large number of authors thus have emphasised the importance of empirical research on DCs to foster the comprehensive understanding and theory development of DC perspective as well as to offer a greater generalisability of findings (Hawass 2010, Rothaermel and Hess 2007). Ambrosini and Bowman (2009, p. 30) for instance conclude that “a dynamic capabilities perspective provides a valuable focus on change processes within the firm. However, owing to a lack of empirical work and problems in deriving managerial prescriptions from the perspective, it currently has limited utility”. Hence, in order to establish DC as a theoretically well founded construct, one that is measurable against its outcome (RR in firms) and also one that is managerial relevant, the exploratory research findings and conceptual enhancement made so far, suggested a strong need for empirical, explanatory research in this area.

In summary, exploratory qualitative research was carried out in the first step of this research, providing the theoretical and conceptual foundation for the descriptive and explanatory (confirmatory) research of the second, quantitative research step. As revealed by the data the latter research step was followed by a further exploratory investigation of the quantitative data by means of model re-specification. The following section further outlines the research methods conducted to complement the research strategy.

4.2.2 Research Methods

In order to implement the research strategy described above, the following section further details the specific research methods applied in this study. Through the application of a mixed method research strategy, which includes a literature review, qualitative and quantitative research methods, and a model validation process, the aim was to create research that can be practically applied whilst also robustly defended in a research environment.

This study intended to start with a **comprehensive literature review** aiming to establish the research context and demarcate it from related fields. Being a central part of the strategic management doctrine, the concept of RR significantly contributes to the resource and competence based research. As the basis for a detailed examination of the concept of RR the resource and competence based research has been outlined as the parent theories for this research. Discussing theories as well as existing empirical studies in the wider field of RR, the literature review provided the theoretical and conceptual base for the development of the conceptual model, leading to a first conceptualisation of the construct of DC and its influence on the likelihood of RR. Furthermore, the antecedents for the development of the DC were subject of investigation.

The literature review thus offered the theoretical foundation for the first, exploratory research step, where **qualitative research methods** were applied subsequently to further specify the preliminary conceptual model and the hypotheses derived. Qualitative research is a means to focus on people's perceptions and meanings in order to explore and understand unknown and complex phenomena in depth and detail (Ticehurst and Veal, 1999, Creswell, 2009). Hence, it has been considered as particularly valuable for the exploration of situations, behaviours or activities (Carson et al., 2001) and the in-depth understanding of new concepts and their interrelationships (Bendapudi and Leone, 2002, Flint et al., 2002). A range of qualitative research methods can be found in literature, including in-depth interviews, group interviews and focus groups, participant observation and ethnography (Ticehurst and Veal, 1999).

Those methods, that have been identified as appropriate for this study, are first, an inductive, **informal discussion forum** and **participant observation** conducted**,** and second, a subsequent **series of in-depth interviews** with key informants from industry environment engaged in RR projects. As both *informal discussion forums* as well as *participant observations* generally help to develop an understanding of the research area and problem and stimulate the creative process (Plewa, 2010), in past research both instruments have frequently been used as qualitative, exploratory research method (Kinnear et al., 1993, Zikmund, 2003). Researchers refer to one key advantage of these methods being their potential to generate new ideas, topics or areas, which might not have been revealed in one-to-one interviews (Plewa, 2010 referring to Kinnear et al., 1993, Zikmund, 2003).

Accordingly, these two qualitative research steps served as a pilot study for the subsequent **series of in-depth interviews**, which have been conducted with industrial representatives. An in-depth interview is defined as a “personal interview, which uses extensive probing to get a single partner respondent to talk freely and to express detailed believes and feelings on a topic” (Kinnear et al., 1993, p. 240). For a qualitative, explanatory research study talking to experts in the area is deemed as an extremely valuable research method in order to gain a comprehensive understanding of a topic prior to a quantitative study (Saunders et al., 2003, p. 97, Ticehurst and Veal, 1999, Plewa, 2010). Hence in-depth interviews are generally regarded as valuable to gain deeper insights or a list of ideas to a complex concept (Fern, 1982), especially when the anticipated information is expected to vary notably across respondents (Ticehurst and Veal, 1999). Based on the newly gained knowledge from this qualitative research step, the conceptual model could be specified and the hypotheses could be qualitatively confirmed. The following chapter 4.3 provides a more detailed description of the qualitative research methods applied, the sampling method, data collection and data analysis procedure, while chapter 4.4 further details the findings from this qualitative research step.

In the second, quantitative research step both descriptive and explanatory research was conducted. Therefore **quantitative research methods** were applied in order to empirically test the conceptual model and the respective hypotheses derived from the literature review and the qualitative research step. For data collection a **self-administered online survey** was carried out. In order to enable the accurate application of statistical procedures and analyses, quantitative research requires the careful planning and structuring of research in advance to ensure accuracy of the research findings (Kinnear et al., 1993), accordingly, standard questionnaire development procedures, a pre-specified sample strategy, and structured data collection methods were conducted (as detailed in chapter 5). In a first step the conceptual model and its constructs were operationalised, whereby whenever suitable measurement items were adopted from existing scales; in case new scales had to be developed standard scale development procedures were applied. After being pre-tested and validated, the developed questionnaire was converted into an online survey using the online survey tool *Unipark*. The study was carried out in companies currently acting in innovation-intensive industries and targeted upper and middle management personnel in the UK. After the data was being collected, in a subsequent confirmatory research step the data was statistically analysed using causal analysis. More specifically structural paths analysis was applied to the data, which enables hypotheses testing, based on **Structural Equation Modelling (SEM)** principles. Accordingly, the conceptual model and related hypotheses were tested using the software *SPSS AMOS 20* for SEM. As revealed by the data, the conceptual model was further re-specified. Such model re-specifications procedures generally aim to achieve a more parsimonious model and are again exploratory in nature (Byrne, 2001, Diamantopoulos, 1994). A description of the quantitative research methods applied, the data collection and sampling, will be provided in chapter 5, while chapter 6 elaborates the quantitative research findings in depth.

4.3 Qualitative Research Methods

As the above chapter illustrated, this research contains a qualitative and a quantitative research part. The following chapter further details the **qualitative research methods** applied in this research to further specify the relevant concepts and interrelations to refine the conceptual framework before being further tested empirically. The different methods used are described in the following chapter.

4.3.1 Informal Discussion Forum and Participant Observation

As a first qualitative, exploratory research step, an informal discussion forum and a participant observation was carried out during the *4th Intercultural Innovation Workshop* in Istanbul, Turkey, organised by noventum consulting GmbH[12] in May 2012. The workshop format was designed as a management workshop directed towards upper and middle management personal and addressed topics such as future and innovation management, with a specific focus on cross innovation and RR. In total 34 managers from different functional areas (amongst them innovation managers, future managers, strategy consultants, CIOs, and IT managers) from diverse industry sectors (e.g. IT, Finance, Consultancy, and Automotive) and intercultural background (Germany, Turkey, India, UK) took part in the workshop.

As part of the *4th Intercultural Innovation Workshop,* an inductive, **informal discussion forum** was conducted in order to gain an in-depth understanding of the research topic, the process of RR and DCs in firms, resources and their interrelationships. Therefore, a one-hour presentation was held by the researcher covering an introduction of the research topic in general, findings derived from the literature review as well as the research gaps as perceived by the researcher. The presentation closed with an outline of the preliminary conceptual model based on the literature review. After the presentation, time was disposed for a group discussion of the concept, related topics and experiences from praxis. The discussion between the participants was moderated by the researcher, however its role was clearly defined as the role of a facilitator of the discussion rather than a discussion leader. This was important in order to ensure that the discussion was kept free flowing and flexible (Ticehurst and Veal, 1999), which facilitated new topics to emerge in the forum (Kinnear et al., 1993,

[12] noventum consulting GmbH is an international IT management consulting group, founded 1996 in Germany. The group is represented in Turkey, Luxembourg and Southafrica. The consulting approach combines strategic and procedural issues with technical solutions. The focus of noventum's service offering lies in the definition, optimisation and implementation of commercial and IT processes, beside this noventum is active in the field of innovation and future management, where service offerings cover the development of future concepts, future management workshops, innovation and ideas management (source: www.noventum.de)

Zikmund, 2003). At the same time special emphasis was given to the manager`s perceptions and interpretation of the concept in order to explore the complex phenomena of RR and DCs in firms in depth and detail, to gain a comprehensive understanding (Ticehurst and Veal, 1999, Creswell, 2009).

Moreover, the developed survey instrument for the DC framework was pre-tested within the workshop following standard scale development procedures to examine the statistical properties of the measurement constructs. Therefore, a **self-evaluation questionnaire** was handed out to the participants (refer to Appendix 4.1). Within the questionnaire, the participants were asked to evaluate their company regarding the four DCs: Sensing, Learning, Integrating and Coordinating Capacities. After being collected and analysed, the anonymised results were discussed with the workshop participants. Therefore, the groups` means for each of the four DCs were graphically illustrated within a spider-matrix and benchmarked against individual anonymised company results. By means of a gap analysis, implications could be derived and were discussed within the group.

As a last element supporting the qualitative research, **a participant observation** was undertaken by the researcher. To enable a playful access to innovation through RR, the *Zukunftsinstitut* in Germany developed the so called *Cross Innovation Game*, which promotes the combination of different industry sectors, market and consumer trends through specific playing cards, in order to trigger the cognitive process of building cross-analogies with the aim to development new innovative products and services (RRs). According to the *Zukunftsinstitut,* the cross innovation approach fosters innovation generation through interdisciplinary combination and linkage of products, services and trends within various industry sectors by means of analogical thinking and cooperation (Steinle et al., 2009, p. 28). Given the task to develop new, innovative RRs by means of playing the *Cross Innovation Game,* the workshop participants were divided into six intercultural groups. The idea generation process was followed by the researcher. This observation based approach was developed as a playful experience directed towards innovation generation stimulating the creative process. For all involved parties, this approach provided access and understanding of a complex and abstract research topic, and therewith a good basis for a subsequent research step, the series of in-depth interviews, where the participants inter alia were asked for their experience during this process.

To conclude, in order to develop a comprehensive understanding of the research topic, and delve into the detailed, micro mechanisms of value creation through RR, while clarifying the notion, role and framework conditions of DCs, an informal discussion forum and participant observation was conducted as first part of the exploratory qualitative research step. Hence, this research step basically served as a pilot study for the subsequent series of in-depth interviews with industrial representatives, further discussed in the following section.

4.3.2 In-Depth Interviews

A series of in-depth interviews were regarded as valuable instrument to further elaborate the conceptual model, discuss the most relevant variables, their conceptualisation and interrelation-ships with respect to the subsequent quantitative part of this research. The following section elaborates on the sampling frame, size and procedure, data collection and data analysis procedure used for the in-depth interviews.

Sampling Frame, Size and Procedure

Following Plewa (2010, p. 91) referring to Kinnear et al. (1993), "a sampling frame is the list of sampling units from which the final sample will be reached". As the concept of RR is relevant in almost all industries regardless of company size, not every company is involved in RR activities. Hence, for the qualitative interviews this research abstained from concentrating on a specific industry sector in order to not limit the potential sampling frame (Plewa, 2012), but targeted key informants on the basis of their experience. Participants were identified as eligible experts on the basis of their involvement and decision-making role in RR activities. The target group for the qualitative interviews were key informants from industry engaged in RR activities, predominantly middle and upper management personnel working in the related fields of innovation, new product development (NPD), business development and strategic management from industry sectors operating in dynamic environments.

A necessary precondition for the selection of the interview partners was, that the interviewees needed to possess an extensive knowledge and experience regarding RR, compromising experience with a minimum of one RR-related activity and experience and knowledge in both, decision-making and day-to-day practice and routines (e.g. Plewa, 2010). Accordingly, the following **four selection criteria** were defined and used to identify eligible interviewees for the sample. First, the interviewee needed to hold one of the following or comparable positions: Innovation manager, R&D manager, NPD managers, future manager, capability manager, business development manager, change manager, strategy consultant. Second, the interviewee needed to be involved in at least one RR related activity (e.g. R&D projects, NPD projects, cross innovation activities, resource allocation processes, business development activities, strategy change projects, transformation projects, capability management and transformation activities, resource planning activities, enterprise architecture management, mergers and acquisitions, business process management). Third, the interviewee were requested to have a minimum of 3 years of experience working with industry. Fourth, the interviewee needed to be formally related to an industry acting in dynamic environments. Following Capron et al. (1998) dynamic environments are characterised by the following criteria: (1) a high frequency of technical and regulatory change, (2) market globalisation, (3) product-market redefinition, (4) and competitive entry.

In accordance with the above predefined selection criteria, four interviewees were chosen from the participants of the *4th Intercultural Innovation Workshop* for an exploratory in-depth interview. Additionally, as previous research regarded snowball sampling as valuable method under the premise that no database of the overall target group is available, identified members of the target group were requested to indicate other experts in the field of research (Plewa, 2010). Additionally two experts in the area of DC and RR were identified by means of referrals as judged by the researcher. In total six interviews were conducted with eligible partners.

To encounter the likely effect of an industry-specific bias (Patton, 2002) and to capture potential differences in view (Plewa et al., 2013), interviewees were chosen to represent a broad sample of different industry sectors (including IT Service Provider, I(C)T Management Consultancy, Strategy Consultancy, Engineering and Product Development), different company sizes (small, medium and large companies), different countries (Germany and Ireland), diverse positions and responsibilities for different focus areas. A detailed list of interview partners is presented in Appendix 4.2, entailing their level of experience[13] in RR activities, position, industry sector, focus area, country(s) the company is active in, interviewee`s nationality (underlined), and company size.

Data Collection

The in-depth interviews were semi-structured in nature and followed an interview guide (see Appendix 4.3). The interview guide consists of a range of different themes, that emerged from the literature review as well as the knowledge gained from the informal discussion round and participant observations. Following common research practice, whilst attention was paid towards a comprehensive discussion of all themes, there was no pre-defined order of the themes to be discussed during the interviews (e.g. Plewa, 2010, Plewa et al., 2013). Less flexibility however was given regarding homogeneity of content. Thus it was ensured that the interview guide and the visualisation material used during the interviews were equal in each case. All items considered, the interview guide method allowed a systematic approach to a series of in-depth interviews, as it ensures that the same themes were covered within each interview, without limiting the opportunity for emerging topics to arise, that have not yet been included in the interview guide (Plewa, 2010; Plewa et al., 2013). Moreover, it also allowed identifying similarities or differences in the views of the different interview partners on certain themes (Plewa, 2010).

[13] All interviewees were categorised based on their self-rated level of experience in RR activities, leading to an equal number of interviewees with a high and moderate level of experience in RR activities.

All interviews were conducted face-to-face, with one exception where the interview was conducted via phone. The interviews lasted between one and two hours. All of them were tape recorded and transcribed afterwards. While tape recording is criticised for the inclination to limit open communication, which might restrain the disclosure of industry or personal information (Carson et al. 2001), at the same time it allows higher flexibility for the data gathering process and greater data comprehensiveness. Therefore, the advantages of this method are argued by many authors to outweigh their limitations (Carson et al., 2001, Patton, 2002, Plewa, 2010), especially as the interview themes are not being regarded as sensitive.

The interviews were conducted to gain a better understanding of the role of DCs in the process of RR. Hence, the interviews concentrated on topics such as RR in the interviewee`s firm with a special focus on the firm`s DCs, processes and routines relevant for RR to occur. Special emphasis was given to the topics on (1) how RRs are developed in firms and how this process can be stimulated and fostered, (2) the notion of DCs, their role and effects towards RR in firms, and (3) the influence of EO and NO on the development of DCs.

First, RR in general was discussed from a broader perspective in order to understanding the role, activities and experience of each interviewee in regard to RR activities, as well as the process of value creation through RR activities. Therefore, the interviewees were questioned about their involvement and general experiences with RR activities in their business area. Thereafter, they were asked to choose one or more successful RR activities they have been engaged in, which then were discussed in more detail in order to identify good practice examples of RR in firms. Furthermore the discussions aimed for a deeper understanding of the relevance and evaluation of RR activities in practice.

Second, to investigate the role of DCs in the process of RR, the DCs of the firm were discussed in order to understand the factors that drive RR in firms and to generate a deeper understanding of the microfoundations of these complex and multifaceted phenomena in practice. Interviewees were asked to outline firm-specific processes and routines underlying the firm`s DCs, their key success drivers and perceived importance for the overall process. The target was to gain knowledge of the fine-grained structure of the firm`s DCs and its influence on building and exploiting the resource base. Moreover, the role and effect of the identified DCs and specific characteristics of the resource bases on the development of new RRs were investigated.

Third, the framework conditions for the development of DCs were discussed in more detail. The aim was to elaborate on factors found in literature, namely EO and NO, which are considered as being relevant for the development of a firm’s DC and thus RR, but at the same time to leave the window open to disclose and identify other antecedents of DCs, which have not been considered in literature.

In a final step, the preliminary conceptual model derived from literature was shown to each interviewee. With that model a set of propositions was discussed outlining (1) how the resource base and the DCs are related to one another, (2) how the relationship between the resource base and RRs is moderated by a firm`s Integrating and Coordinating capacity, (3) how EO and NO might affect the development and utilisation of DCs for RRs. This merging step was conducted to discuss and validate the preliminary conceptual model and the hypotheses derived from the literature review and align it with the experience reported from praxis as unveiled by the interviewees. The visualisation of the conceptual model allowed an illustration of the constructs discussed, facilitated a judgment regarding the relevance of the single items compared to others, and enabled a clarification of their interdependencies and linkages. In line with previous research findings using a similar methodological approach (e.g. Plewa, 2010), this final step was considered extremely valuable for the development and refinement of the conceptual model on the basis of the most relevant constructs and their interrelations. Interviews lasted until consensus was reached on the relevant constructs to be included in the quantitative study.

Data Analysis

Based on the full transcription of tape records, the in-depth interviews were analysed using the digital coding software *NVivo 8* (QSR). *NVivo* is a software package supporting the qualitative data analysis, especially when rich text-based information is subject of investigation, as it helps researchers to classify, sort and arrange information and analyse relationships and tendencies in qualitative data. For the content analysis so called 'nodes' were build based on the literature review results and the themes covered in the interview guide as common in research practice (e.g. Huberman and Miles, 1994, Plewa, 2010, Plewa et al., 2013). *NVivo* therewith supports the iterative process of structuring the qualitative data and allows a systematic review and analysis of the interview data until a thorough understanding of the research topic, the relevant constructs and relevant measures was deduced (Carson et al., 2001). This approach offered valuable insights and emerging themes, which were used to conceptualise RR in firms from a DC perspective. The findings derived from the qualitative data analysis, utilised to refine the conceptual model and hypotheses for the subsequent, quantitative research step, are presented in the following section.

4.4 Results from the Qualitative Research

The following section briefly discusses the results of the qualitative research step to further refine the conceptual model and the respective hypotheses derived from the literature review and convert it into a qualitatively proven conceptual model. Therefore, the discussion below refers to the preliminary conceptual model, including the most relevant variables, their conceptualisations and interrelationships in the model, with respect to refine the model to be empirically tested in the subsequent quantitative part of this research.[14]

4.4.1 Resource Recombination: Performance Outcomes and Value Creation

Confirming the importance of RR in firms, the data reflects the highly complex nature of value creation in firms through RR and the variety of benefits that might determine the perceived value of RR in firms. The purpose of RR as described in the innovation literature is to build unique and innovative bundles of resources and thereby to achieve competitive advantages (Galunic and Rodan, 1998). The relevance of the concept of RR for building new innovative products and services was confirmed clearly by the interviewees, for instance interviewee #1 stated:

> *"Often single components […] build common services, easily to access and to imitate, but through combination it becomes a service that is unique and new. Hence, for us the particular aim was to develop something inimitable through the combination of resources […] and it emerged, that this gave us a new profile. The core interest certainly was to obtain and to retain future fitness for the company. Doing so, we want to make sure to develop solutions that meet the future demands of the customers." (Interviewee #1)*

Whereby special emphasis was placed by those interviewees coming from small and medium sized companies towards *interorganisational* RR activities through external networks and partnerships, as illustrated by the following quote:

> *"For our company, resource recombination is extremely important. I personally think, that as a medium sized enterprise we do not have the vast variety of different resources to adequately correspond to all customer needs. For this reasoning, an intelligent network consistent of complementary skills of different partners or organisations is extremely important to stay competitive in the long run." (Interviewee #4)*

Moreover, RR was supported by the interviewees as appropriate measure of innovation in firms and therefore was confirmed as valuable indicator of current entrepreneurial activities within the firm (Brown et al., 2001, Lumpkin and Dess, 1996, Stopford and Baden-Fuller, 1994). Aiming at the determination of value creation in firms through RR, however, findings reveal that the vast majority

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[14] Note from the author: The quotes from the interviews display the original and transcribed outcome of the interviews, which is that often interviewees interrupted sentences, switched their thoughts within the same sentence, and used a rough wording. Nonetheless, to avoid any change of meaning, the quotes were included in its original wording without any grammatical or language corrections.

of companies surveyed did not perform a direct evaluation of RR success. One reason may be, that for most interviewees it emerged as difficult to define appropriate KPI's for measuring RR success. Interviewees appeared indifferent on whether to apply hard figures, such as turnover and profit, or additionally to incorporate soft figures, such as innovativeness, brand reputation and image. The statement of one interviewee may best describe the trade-off: *„Often as important as making profit with our RR products, is the benefit to attract awareness of our customers" (Interviewee #1)*

As a result, findings revealed that involved parties perceived different outcomes of RR as beneficial, confirming the appropriateness of employing RR as an overall outcome measure, and rather focusing on the extent to which firms engage in distinct RR activities, than measuring performance outcomes.

4.4.2 Dynamic Capabilities: Their Notions, Interrelationships and Impact on Outcome Variables

Capabilities in general. Looking at capabilities from a more general perspective, findings confirmed the relevance of the concept and its complex nature. At the same time interviewees presented a highly differentiated view of capabilities in firms, distinguishing between different subsets of capabilities – *Operational* and *Dynamic Capabilities* – even though in practice different notions for describing related concepts as proposed in literature were used, as the following quote illustrates:

> *"The concept of capabilities exists. (…) One is **business capability** and the other is **technical capability**. (…) So it is very important to understand that you have two sets of capabilities: One is what the business is trying to do (business capability), and then the other is really how it is actually doing it (technical capability)." (Interviewee #3)*

The perception of capabilities as described in this quote is consistent with literature (e.g. Helfat et al., 2007, Winter, 2003, Zollo and Winter, 2002), describing **Operational Capabilities**, as those that are associated with typical, day to day operations within the company, and **Dynamic Capabilities**, referring to those that involve creation and change.

Dynamic Capabilities. Investigating the role of DCs in the process of RR, first the relevance and notion of DCs were discussed. Data revealed a growing relevance of DCs, as it becomes ever more important in today's business environment to develop unique combinations of resources, considering that in an increasingly interconnected business environment, resources, technologies, even operational capabilities are becoming increasingly uniform across industries (e.g. as they can be easily applied via strategic factor markets, networks or alliances), and therefore seldom meet the criteria of being VRIN (Barney, 1991). This progress is well described by interviewee #3:

"If we take matured industries, you will find that the companies have evolved and in many ways do all very similar things. So you need to look then at the capabilities, to say, which capabilities are the ones that make me different, which are the ones that I believe are gonna make me even more successful in the future, and which are the ones that are commodities; and the commodities are the ones that can be outsourced. (...) the real thing is to determine, not just what you are doing today, and what you are doing well, but somehow trying to say, how to concentrate the company to find new capabilities or prioritise the existing capabilities, which will make a difference to go forward. So it's all about differentiation and ongoing performance." (Interviewee #3)

Accordingly, the DCs of the firm, defined as a "firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments" (Teece, 1997, p. 516), is regarded as crucial in order to develop new innovative RRs. Moreover, at the same time data confirmed the perceived role of DCs lying in the heart of business strategy and management, as stated by one of the interviewees:

"I see business strategy being about deciding (1) which capabilities they want, (2) how should they be adjusted, (3) how should they be managed, and (4) how should they be evolved over time." Associated are questions, such as: *"What changes do we want to make? How do we manage the transition from the technical capabilities we have today, and the people associated with those capabilities, or the people who are managing those capabilities? How to adjust that from what we have to today, to where we want to be? And this goes back then to the stage, where you need to start looking at resources." (Interviewee #3).*

Hence, for managing this transition phase, the DCs of the firm - especially the Sensing and Learning capacity - are important as these capabilities allow firms to change the existing resource base, or existing skills and develop them into new skills. Thus, while data confirmed that the concept of capabilities is commonly known and widely accepted also from a business perspective, considerable ambiguity existed among interviewees concerning their exact definition, or what was noted by Galunic and Rodan (1998) as the question of what defines their boundaries. Not seldom interviewees referred to different levels of granularity of the concept, a point well captured by interviewee #3:

*"And below these **high level capabilities** we would have a hierarchy, so there would be second level, third level or maybe even more levels of capabilities. (...) And what you will find is that these capabilities eventually start to become very like **processes**. So once you go far enough down the hierarchy, capabilities should almost correspond to processes.* [However] *(...) companies confused business capabilities with processes (...). Every process can cover more than one capability, but maybe more than one process is required for a capability. I think this relationship is complicated." (Interviewee #3)*

For the operationalisation of the constructs in the conceptual model, therefore, this research stays on a higher level of granularity investigating specific routines and processes, but at the same time abstains from investigating the fine-grained sub-processes and activities constituting each capability. Notwithstanding, it is clearly stated that the **microfoundations of capabilities** are processes and activities (Parmigiani and Howard-Greenville, 2011), which in terms are performed by people, and use resources; a perception which was also supported by the interviewees:

> *"And of course every capability (…) would also have to have a certain **skill set** associated with it, in terms of people. **People** will need to automatically manage these **processes** (…), so there will be people associated with (…) actually managing those capabilities and they would need to have **technical skills**." (Interviewee #3)*

> *"According to our understanding, capabilities always have at least three dimensions, these are the **people**, the **processes** and the **resources** (including IT, etc). From my point of view, one could additionally bring in the product level, which also can be seen as the result of a capability." (Interviewee #6)*

In the following section, the specific DCs of the firm will be investigated in more detail in order to understand factors that drive RR and to generate a deeper understanding of the microfoundations of these complex and multifaceted phenomena in practice and discuss the proposed interrelationships and their impact on RR outcomes.

Sensing Capacity. Sensing capacity, defined as the firm`s ability to spot, interpret and pursue opportunities in the internal and external environment (Teece, 2007, Pavlou and El Sawy, 2011), was confirmed by the data as an essential sub-capability of the firms DC, with all interviewees describing its critical role for identifying and shaping new opportunities. The following statement, given by one of the interviewees, well captures the organisational challenges affiliated to business development, which requires the development of a firm`s Sensing capacity:

> *"There are certain things that are externally defined (…), so this is the **content** that feeds to the strategy of a company. So the challenge for the management is to look at these [content], e.g. best practice and challenges, to try and relate them to their own particular company, and somehow customise them and map them back onto the actual work that is happening within the company. With that, they will develop new projects." (Interviewee #3)*

Moreover, while qualitative findings showed, that Sensing capacity is rather externally oriented towards identifying and seizing opportunities in the external environment, interview data revealed, that the demand for addressing new opportunities can either be externally or internally initiated:

> *"What we tend to call these new challenges would be, we term them as being a **demand**. (…) The demand could be coming from a new strategy (e.g. innovation, or to combat competition, or to create growth), it could be coming from some outside regulations (like there are maybe some new laws or new standards), or it could be coming from your existing business, whereby you have existing products or services that are going on and people are requesting changes." (Interviewee #3)*

Correspondingly, the critical role of developing a high Sensing capacity in the context of RRs, was confirmed clearly by the interviews for example, interviewee #4 stated that:

> *"A crucial task is to identify market trends, to evaluate what may become relevant for the company in the future, but moreover drawing conclusions for the core business of the company, e.g. how people will behave in the future, what influence future developments will have on our employees, customers etc. Moreover it is important to focus on technological developments in the environment, for example what IT trends are arising. This is especially important for our company, as normally, the IT-industry is characterised by cycles of five years, and when you are missing one or another important trends then it could have tremendous effects for the company." (Interviewee #4)*

As described in this quote, the conceptualisation of Sensing capacity developed on the basis of the literature review, which captures the three basic routines, namely (1) *Generating Market Intelligence* (e.g. Amit and Schoemaker, 1993, Pavlou and El Sawy, 2011), (2) G*enerating Customer and Competitor Intelligence* (e.g. Teece, 2007, Pavlou and El Sawy, 2011), and (3) *Generating Technological Intelligence* (e.g. Teece, 2007), could be confirmed.

Moreover, investigating the microfoundations of Sensing capacity, the three underlying processes and activities constituting a firms Sensing capacity that emerged from the literature review, namely (1) *spotting, scanning and monitoring the environment* (e.g. Teece, 2007, Nelson and Winter, 1982), (2) *accumulating, filtering and interpreting available information* (e.g. Teece, 2007), and (3) *valuing, identifying and shaping opportunities* (e.g. Teece, 2007), were confirmed by the qualitative findings.

While special emphasis was placed by the interviewees on the first, identifying process step, a general awareness of the relevance of the subsequent process steps of evaluating information ('accumulating, filtering and interpreting available information') and seizing new opportunities ('valuing, identifying and shaping opportunities'), were expressed by the majority of interviewees, as outlined by the following quotes:

> *„Cloud computing, for example, is a highly recognised topic at the moment, but in order to* ***evaluate*** *its relevance (what does this mean for our company specifically?), it is not enough only to point out that cloud computing is an interesting topic for the future. Moreover, we also have to ask ourselves how to address this market, whether we have got the required resources, and what we as a company could do to participate successfully in the market. (Interviewee #4).*

> *"And the other thing is to actually say, do we even want to do the demand? So again, we could have a demand for something, but it is not really part of our strategy and therefore we might want to reject that project." (Interviewee #3).*

> *"And then after all of that, you have a list of* ***qualified*** *or* ***approved*** *demands and you somehow need to* ***prioritise*** *them to say, which ones are the most important and which ones are the least important. And there is a whole lot of measurements that you could apply to that in terms of KPIs or even things like." (Interviewee #3)*

Notwithstanding its relevance, however findings also revealed that firms often described problems in finding systematically ways of filtering and seizing new opportunities:

> *"The next step would be, that the identified, relevant information is processed further. This is partially methodical, but not yet consistent"* (Interviewee #1).

Hence, given the importance of Sensing capacity, the data reflected the highly complex nature of the concept. Moreover, consistent with research findings derived from the literature review, qualitative data could confirm the suggested positive relation between Sensing capacity and RR in firms, through its positive effect on Market and Technological Knowledge. Thus interview findings substantiated a proposed positive impact on RR in firms.

Learning Capacity. Learning capacity is described as the firm`s ability to assimilate, accumulate, retain, and create (new) knowledge to revamp the firm`s resource base with substantial knowledge, developed internally or obtained externally (Pavlou and El Sawy, 2011, Zahra and George, 2002). Interviewees ascribed high recognition to the construct of Learning capacity:

> *"Learning is important for a lot of business processes, especially for RR, as this is a special type of business development. Here, learning is especially important as we enter a lot of unknown territory." (Interviewee #1)*

Hence, Learning capacity was confirmed by the data as an important sub-capability of the firms DC, with interviewees approving its central role in renewing the firm`s existing resource base with new knowledge. For instance, interviewee #4 stated:

> *"First, you need to be aware of the existing knowledge, second, you need to be aware of the missing knowledge and then, finally, you need to be willing to invest [e.g. time and money] in that missing knowledge by learning new knowledge (on the basis of knowing what might be important in the future) in order to eliminate or minimise the existing knowledge gaps. And this final step can either be realised with the help of internal resources [e.g. re-skilling, training, internal R&D] or through partnering by means of acquiring or bundling external resources." (Interviewee #4)*

Investigating the microfoundations of Learning capacity, qualitative findings moreover confirmed the three underlying routines of Learning capacity: (1) *Acquiring and Assimilating of external knowledge*, which captures the processes of *Knowledge Acquisition* and *Knowledge Assimilation* (e.g. Zahra and George, 2002, Sirmon et al., 2007, Pavlou an El Sawy, 2011), (2) *Creating new internal knowledge*, which refers to the internal knowledge exploration and creation of new knowledge (Rothaermel and Hess, 2007), and (3) *Accumulating and Retaining internal knowledge,* which refers to internally managing and retaining knowledge over time (Garud and Nayyar, 1994, Dierickx and Cool, 1989). At the same time it became apparent that most often, learning new knowledge entails acquiring knowledge from external sources, as for instance stated by one interviewee:

"Normally firms cannot randomly expand and enlarge their existing competences as they would like to in the required depth, they necessarily need to acquire external competencies to complement their internal resources" (Interviewee #1).

Accordingly, interviewees confirmed the argument propound by researchers (e.g. Lichtenthaler and Lichtenthaler, 2009, Argote et al., 2003, Gulati, 1999, Wiklund and Shepherd, 2009), that firms increasingly rely on interorganisational knowledge transactions to extend their internal knowledge base. Moreover special emphasis was placed on the third routine *Knowledge Accumulation and Retention*, as the following statement shows:

*"Companies don`t really understand what they have. So one of the big challenges is to understand first of all, what we actually have today, what technologies we are supporting, etc. Once we know what technologies we are supporting, we need to find out what people and expertise are required in order to support these technologies (…) All these are decisions that need to be made - unless **you know what exists** and unless you have some **way of categorising resources**, it`s just meaningless. You have to have a baseline" (Interviewee #3)*

While interview data generally confirmed the high relevance of *Knowledge Accumulation and Retention* being an important routine underlying the Learning capacity, interviewees especially pointed towards the processes of *Knowledge Articulation* and *Unlearning* as important sub-processes constituting this routine.

First, *Knowledge Articulation* describes the process of actively converting implicit into explicit knowledge by communicating and interacting throughout the organisation. Its relevance for assuring sustainable learning mechanisms within the firm is well described by the following statement:

"If I have a knowledge management system, where I insert all the relevant knowledge and information, I have not yet gained quite a lot. (…) Instead, in order to be used in the right context, it must be put into the right place within the organisation and therefore first and foremost requires a basic understanding of the area of knowledge. I have not yet found a solution for this challenge, how best to bring the knowledge relevant for our business into real action." (Interviewee #1)

Second, *Unlearning* refers to the process of divesting valuable resources or resources that have become obsolete over time (Sirmon et al. 2007, Leonard-Barton, 1992). Interviewees emphasised the ongoing challenge of renewing the existing knowledge base, not only by acquiring new knowledge, but also by releasing outdated knowledge. The statement of one interviewee may best describe the complex and versatile nature of this organisational learning mechanism:

"Companies spend an awful lot of time just supporting and maintaining things, 80% of their budget, just maintaining what they have. (…) So each year the amount of maintenance cost for operational capabilities gets bigger and bigger. So you have to kill some things in order to free up money to spend on

new things. (…) Somehow you need to phase out the old technology and to place in the new technology, and therefore the skills." (Interviewee #3)

Taken together, in accordance to the conceptual findings revealed from the literature review, Learning capacity was confirmed by the interviews to positively influence RR in firms by renewing and retaining the firms knowledge base, specifically its Market and Technological Knowledge, in ways that enable it to become the 'raw material' for recombinant innovation.

Integrating Capacity. Besides Sensing and Learning capacities, also Integrating and Coordinating capacities were confirmed by the qualitative data as highly important for RR success, confirming the conceptual framework developed on the basis of the literature review. Integrating capacity, which describes the firm`s ability to creatively combine, integrate and transform knowledge based resources in new ways to construct or alter new operational capabilities for the purpose of developing new innovative products or services (e.g. Pavlou and El Sawy, 2011, Zahra and George, 2002), was confirmed by the data as important capability in the RR process in firms.

"Integration often it is just a linkage of interpersonal communication. " (Interviewee #1)

The qualitative data analysis emphasised the importance of integration, with interviewees describing communication as extremely important, but often not interactive enough to successfully link diverse domains of knowledge within the company to create new, innovative RRs.

"Over and over again I notice that often it`s during the informal talks with my colleagues from different operational areas, (e.g. during lunch breaks), when we discuss current business problems, and when the most promising ideas and new solutions are coming up, those that have been very helpful. If we were able to institutionalise and systematise these informal talks in our company, then this would result in a great success. I am pretty sure about this." (Interviewee #4)

While the construct of Integration capacity involves bilateral communication, it goes further by including frequent interactions, participation and involvement of parties in the overall process. Hence, integration, rather than communication, was incorporated into the final path model.

*„For us 'Integration' can basically be seen at two levels: First there is the **internal integration**, meaning that we have different business areas which can practice what we refer to as cross innovation [RR]. This is supported by our internal knowledge development process, (…) a central process that takes into consideration how different products internally to the firm can be bundled in new combinations. (…) So we possess the capability to integrate two things, which in sum solves a specific customer problem. Second, there is the **external integration**, basically the same processes, with the only difference that we internally possess one component A, which is combined with an external component B." (Interviewee #1)*

Accordingly, the three underlying routines of Integrating capacity, its constituting processes and underlying activities, namely (1) *Transforming individual to collective knowledge*, which refers to the processes of *contribution* and *representation* of individual and group knowledge (Pavlou and El Sawy, 2011), (2) *Interrelating different knowledge domains*, which refers to the processes of *Interrelation* of diverse knowledge inputs to the collective system (Grant, 1996) and the *Execution* of collective activities (Helfat and Peteraf, 2003), (3) *Reconfiguration and Refinement,* which captures the internal integration and transformation processes (Lavie, 2006, Hawass, 2010, Galunic and Rodan, 1998), could be confirmed by the interviewees.

In our data, Integrating capacity was linked to RR outcomes and was also described as influencing the relationship between firm`s resource base and RR (e.g. interviewees #1, #4), supporting literature findings (Sirmon et al., 2007, Pavlou and El Sawy, 2011). In sum, in accordance with the theoretical arguments synthesised from the literature review, the proposed positive relationship between Integrating capacity and RR in firms could be confirmed by the qualitative data. Accordingly, it can be proposed that the higher the firm`s Integrating capacity, the more likely it is for firms to be able to realise novel RRs.

Coordinating Capacity. In a similar vein, Coordinating capacity, which describes the firm´s ability to orchestrate and deploy tasks, resources, and activities in new operational capabilities in order to implement new, innovative products or services (RRs) in the market, emerged from the qualitative data as essential sub-capability of the firms DC, with interviewees referring to its critical role for leveraging the value creation potential of the resources by implementing and exploiting new products and services. Likewise for Integrating capacity, support was found for the importance of Coordinating capacity for the successful deployment of RRs.

In line with what the findings from the literature review suggested (e.g. Sirmon et al., 2010), interviewees described the necessity of having a vision or plan of those resources, capabilities, and skills needed to form the new operational capabilities to implement new RRs as an essential element of the firm`s Coordination capacity, allowing an efficient *Allocation* and *Mobilisation* of resources. For example, interviewee #1 stated:

> *"There are definitely certain challenges concerned with 'Coordination', one important for instance is, that I have to take care of developing people according to those skills types presumably needed in the future. (…) This would also involve a kind of capability model, where I have to allocate resources available (…) in order to answer the questions: Do I have the right resources to address the requested demand? And vice versa, can every resource be assigned to address a specific demand in the future, or do I have resources where I have to divest, as the skills in that specific area are not needed in the future anymore? (…) This is not an automated system,* rather more it is implicit knowledge." (Interviewee #1)

Moreover, interviewees highlighted the ongoing challenge of *Coordinating* and *Orchestrating* of resources, capabilities and skills for being deployed into new capability configurations (Sirmon et al., 2007, 2010), while special emphasise was given by the respondents on the complexity of finding systematic ways of mapping those resources available in the firms:

> *"Once we have made all those distinctions, we essentially have a plan in terms of what we want to do. And the next thing then is that we need to somehow* ***map my resources*** *onto that: what resources are available and how can they be somehow assigned to the master plan that we have created." (Interviewee #3)*

Notwithstanding its relevance, however findings also revealed that firms often experience problems in finding systematically ways for synchronising tasks and activities (Helfat and Peteraf, 2003), and identifying complementarities and synergies among tasks and resources (Eisenhardt and Galunic, 2000, Pavlou and El Sawy, 2011), as not always systematic ways exists within the firms that allow to precisely describe and capture the different skills and capabilities available within the firm. This is well expressed by the following statement:

> *"The problem is that as a scientific measure it [a capability map] is not very reliable. The top people have multiple skills and if you put them into two different skill type buckets, e.g. as a programmer and as a project manager, then you have to be careful as you need to make sure that they don`t double count. So how companies manage that is really on them to decide." (Interviewee #3)*

Overall, qualitative data confirmed the three **basic routines underlying Coordinating capacity,** namely (1) *Allocating and Mobilising Resources* needed to address the demand (Sirmon et al., 2007), (2) *Coordinating and Orchestrating Resources* for being deployed into effective yet efficient capability configurations (Sirmon et al., 2007, 2010), and (3) *Implementing and Deploying new configurations* in the market to leverage and exploit resource opportunities (Sirmon et al., 2007, 2010). Moreover interview findings approved the proposition deduced from the literature review, suggesting that a high Coordinating capacity would be positively associated with RR in firms, as the effective coordination of resources is proposed to result in implementing and exploiting new products in the market by leveraging the value creation potential of the resources.

Taken together, Sensing, Learning, Integrating and Coordinating capacities were confirmed during qualitative data analysis as key drivers of RR in firms, and their microfoundations could be affirmed. The following section details the verification of the proposed characteristics of the resource base that are suggested to influence the potential value of resources for RR.

4.4.3 Characteristics of the Resource Base: Relevance for Resource Recombination

While interviews primarily focused on the discussion of *resource diversity, resource quality, resource complementarity, resource deployment flexibility, and resource transferability* as relevant characteristics of the resource base highlighted in the resource based literature, interviewees were also encouraged to freely discuss other relevant characteristics in order to not only confirm and refine the conceptual framework, but also to avoid the potential failure of disregarding relevant influencing factors. Interview findings clearly substantiated the importance of the given resource characteristics in a given RR context.

Resource Diversity. Resource diversity, captured by Market and Technological Knowledge *Breadth*, and defined as the number or range of different knowledge areas the firm is familiar with (De Luca and Atuahene-Gima, 2007, Bierly and Chakrabarti, 1996), was confirmed by the interviews as relevant characteristic of the resource base influencing its potential value for RR. Interviewees were consistent in their perception that the heterogeneity of resources may have an influence on RR in firms. While the majority of literature proposes that firms with a broad knowledge base have a greater potential to recombine different elements of that knowledge and thus generate more possibilities for new RRs by improving opportunity recognition and creative potential (Kogut and Zander 1992, Reed and DeFillippi, 1990, Granstand and Sjölander, 1988, 1990, Galunic and Rodan, 1998, De Luca and Atuahene-Gima, 2007), interview findings revealed that too much diversity may also hinder the development of RR, as stated by one of the interviewees:

> *"Maybe you can manage up to a hundred of different skill types within a company. I don`t know. But it is not an endless number. Otherwise it can`t be managed anymore. And therefore it can`t be at that individual level anymore. (…) If there are too many skill types it becomes too difficult to manage and also it becomes expensive." (Interviewee #3)*

This finding is consistent with Galunic and Rodan (1998), De Luca and Atuahene-Gima (2007), Tushman and Romanelli (1996), Teece et al. (1997), Björk and Magnusson (2008), who found that a high degree of resource diversity may also lead to an enhanced complexity of knowledge transfer across functional units. Hence, findings suggest that there might be an optimum of different skill types within a firm, meaning that up to a certain degree it might be good to have diverse skill types but at a certain point resource diversity becomes too high to effectively being managed, unless firms possess the needed integration and coordination mechanisms.

Resource Quality. Besides resource diversity, the quality of resources, captured by Market and Technological Knowledge *Depth*, and defined in this study as the level of sophistication and complexity of the firm`s knowledge in a specific area (De Luca and Atuahene-Gima, 2007), was also confirmed by the interviewees as a decisive characteristic influencing the value creation potential of resources. However, findings also revealed that possessing high qualitative resources alone would not automatically lead to competitive advantages over time:

> *"I would rather doubt the proposition, that if you have a lot of high quality individual players it also works out collectively. Concerning the quality, I would rather say, that you need to have the right mix [of resources]" (Interviewee #1)*

Notably, qualitative findings already indicated, what also emerged later from the quantitative data, that respondents had difficulties in differentiating between knowledge *breadth* and *depth*. For reducing complexity of the study, and as both categories appeared to be closely related to each other, breadth and depth of knowledge were merged to a single construct in the quantitative analysis, used to measure the quality and diversity of Market Knowledge (breadth and depth) and Technological Knowledge (breadth and depth).

Resource Complementarity. The complementarity of resources, specifically Market and Technological Knowledge (Hitt et al., 2001, Song et al., 2005), was also supported by the interviewees as important factor, as already indicated by the previous quote by interviewee (#1). Resource complementarity, rather than resource modularity, was included in the model as the term caused less ambiguity in respondent`s understanding.

Resource Transferability. In comparison to resource quality, diversity and complementarity, interviewees appeared to assign less recognition and significance to resource transferability, which referred to the degree to which resources within the firm are transferred and articulated easily across disciplines (De Luca and Atuahene-Gima, 2007). Still support was found among interviewees that the tacitness of resources might have a negative effect on the exchange and absorption of knowledge across competence areas.

Resource Deployment Flexibility. The flexibility of resources available in firms refers to the degree to which the resources available in a firm are generalisable and flexible for being deployed in different areas apart from their original context. In this research resource deployment flexibility is captured by the context-specificity of knowledge, which describes "the extent to which the firm's knowledge is tailored to the requirements of specific contexts" (De Luca, 2007, p. 98). Interviews generally acknowledge the importance of resource flexibility for their deployment in new RRs:

> *"Some people [resources] indeed have the ability to be applicable in various different project prototypes [RRs], meaning that for both from skills [resources] to project prototypes [RRs] as well as from the prototypes [RRs] to customer demands are certain flexibilities. This allows, that these resources can be put together modularly [in new RRs]." (Interviewee #1)*

Moreover, while profound arguments can be found that support a high degree of specialisation in firms, consistent with the argument by Galunic and Rodan (1998), interview findings revealed that in the context of RR in firms a high level of specialisation and context-specificity may hinder resources from being applied elsewhere, a point well captured by interviewee #3 describing two scenarios:

> *"[One scenario is that you have] people and some of them are very specialised, they are focused only on a very small part of their business. You might have a whole team of people, who are very expensive and very highly skilled people, but they are only supporting something that contributes only 1% to your overall business. (...)*
>
> *The other scenario is that the company has somehow evolved and became quite mature and it has a small number of technologies that are common right across the business. (...) Say, you have a big team of people with Microsoft skills, because this technology is used in 50% of our business, these people can be moved very easy, they are more flexible because they have a common skill set, that can easily be applied to the major technologies that the business uses. And that major technologies support a lot of the business capabilities. This means that they are more flexible in terms of mobility and how they can be used." (Interviewee #3)*

Accordingly, findings support the proposition, that the lower the context specificity and thus the higher the resource deployment flexibility of the resources, the higher its potential value for RR.

Resource Renewal. Addressing the origin of firm`s resources, resource renewal was mentioned by the interviewees as additional characteristic that may influence RR in firms. Findings emerged that the degree to which the firm`s resources consist of 'newly acquired' or 'already existing' resources (e.g. Wiklund and Shepherd, 2009) may have an effect on RR in firms. However, respondents were indifferent whether the origin of resources may persist as decisive characteristic influencing the value creation potential of resources, as long as integration is given.

To conclude, interviews clearly substantiated the relevance of certain characteristics of the resource base for determining the value creation potential of resources for RR. In particular, *resource diversity, resource quality, resource complementarity, resource transferability, resource deployment flexibility* and *resource renewal* were confirmed by the interviews as relevant characteristics and are consequently included in the conceptual model. However, for reducing complexity of the model, the results indicated the relevance of merging in the final model the quality and diversity of Market Knowledge (breadth and depth), and Technological Knowledge (breadth and depth), respectively, instead of measuring knowledge breadth and depth separately, as respondents had difficulties in differentiating between the two constructs. Based on the discussion of the DC constructs and their interrelationships, the two proposed antecedents, Entrepreneurial Orientation and Networking Orientation, and their proposed interrelationships and impact on DCs are discussed in the subsequent section.

4.4.4 Entrepreneurial and Networking Orientation: Antecedents to Dynamic Capabilities

Respondents agreed that organisations differ in their strategic orientation, for instance the *willing-ness* or *attitude* of the firms concerning the engagement in entrepreneurial behaviour (Wiklund, 1998) or interfirm collaborations (Mu and Di Benedetto, 2012). Qualitative findings supported the conceptual framework, stressing the importance of organisational framework conditions, relevant for the development of DCs and thus RRs (Hawass, 2010).

Entrepreneurial Orientation. Entrepreneurial Orientation (EO), which characterises the firm`s entrepreneurial behaviour, commonly regarded as a combination of *innovativeness, proactiveness,* and *risk-taking* (Lumpkin and Dess, 1996, Wiklund and Shepherd, 2003), was confirmed by the interviewees as decisive factor relevant for the development of DCs, and consequently RR. Its relevance is well described by the following statement given by one of the interviewees:

> *"A crucial factor that needs to be in place is the attitude, always to enjoy pursuing something new, instead of being satisfied with the old, hence never to stay still and to rest. However, the common attitude in firms is 'what performed well in the past, will be performing well in the future', and certainly it might be that a lot of things will still perform well in the future, but the initiative and desire to continuously strive to find things that can be improved in the future to become even better, is a crucial precondition that this even happens. Otherwise one only concentrates on the core competences and loses everything else. (Interviewee #1)*

Interviewee #1 further specified the importance of EO for RR in firms as follows:

> *"Innovation is demanding, even more demanding are RRs. And in the end over 80% of all projects fail, what might be seen as proof for 'would we rather have done it the old way, than we wouldn`t have wasted all the money', but in the end it is the 20% that actually makes the difference." (Interviewee #1)*

Networking Orientation. Besides EO, also Networking Orientation (NO), which captures the firm`s strategic orientation towards collaborating with external entities (Mu and Di Benedetto, 2011), emerged from the qualitative data as important antecedent for DCs, with interviewees highlighting the increasing relevance of collaborating with external partners for extending their own competences. Interviewee #1 for instance stated:

> *"Knowing that on the one hand side I have my core competence, but on the other hand side the customer will become more and more demanding in the future, and consequently will require more than I can offer as I cannot randomly expand or enlarge my competences within the desired depth, I necessarily need to acquire external competencies." (Interviewee #1)*

Being asked for important framework conditions driving RR in firms, interviewee #1 further stated:

> *"This certainly is **openness** and the **ability to communicate** with partners. This comprises a form of **external trust culture**, meaning that you are open towards your partner, instead of thinking, how can I demarcate my own products and services offerings from my partner`s activities. (...) Once you have the motivation to establish this [RR in firms], **openness** is the necessary precondition that actually makes it functioning. It is especially necessary for the efficiency [of the RR process], because if you do not collaborate with partners you will permanently run against walls, which costs you a lot of energy. Openness, instead, enables you to run through open doors." (Interviewee #1)*

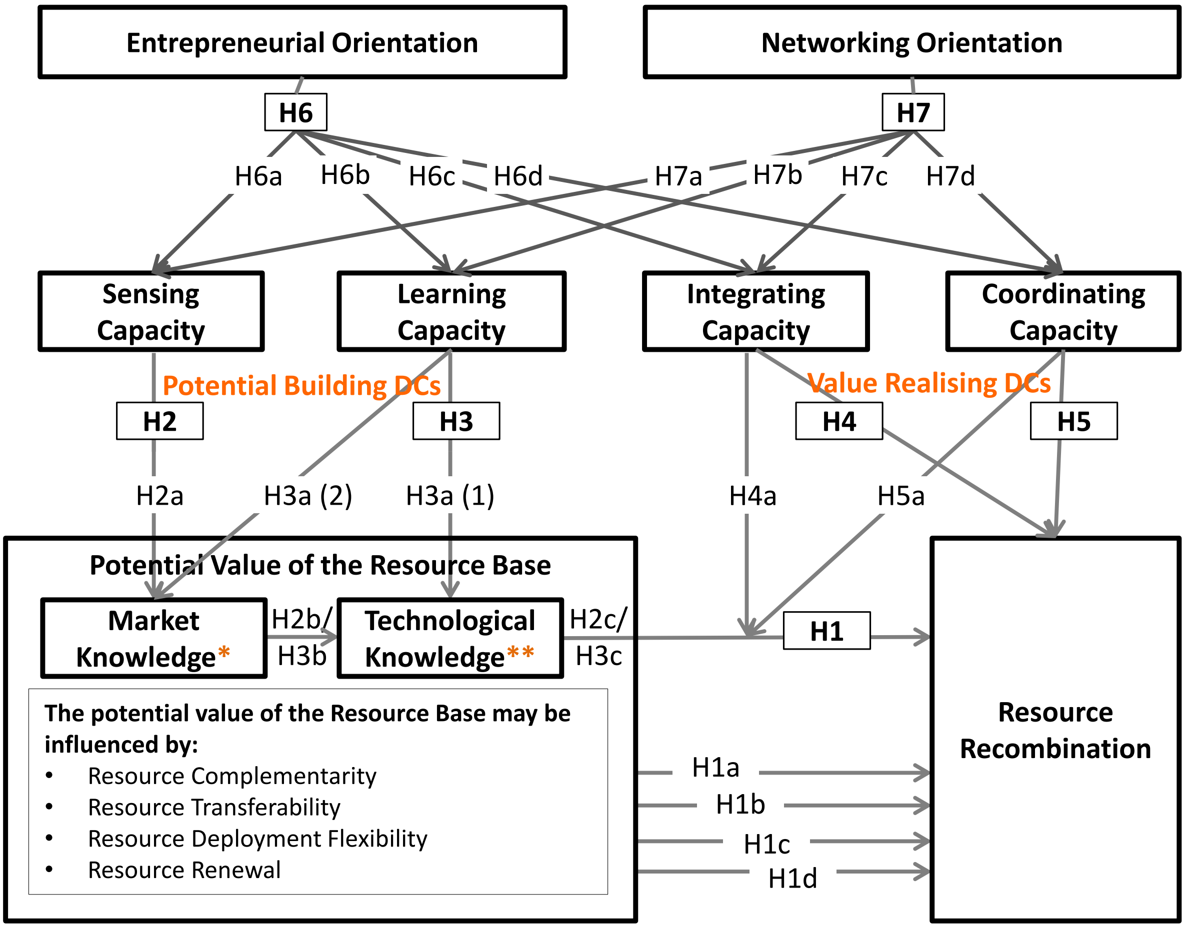
Accordingly, as qualitative findings reveal, both EO and NO were described by the respondents as important organisational framework conditions for the development of DCs, confirming the conceptual findings that emerged from the literature review.

4.5 Chapter Summary

This chapter started with an outline of the research design, entailing the research strategy and general research methods applied in this research. Subsequently the qualitative research methods used were outlined, including a description of the *informal discussion forum* and *participant observation* and the subsequent *in-depth interviews* conducted. In the second part of this chapter the results from the qualitative research steps were presented. The main purpose of the qualitative research step was to validate and refine the model before the quantitative research was conducted. Based on a structured content analysis of the qualitative data, the preliminary conceptual model could be confirmed, while minor adjustments were discussed and justified, leading to the qualitatively proven conceptual model, illustrated in Figure 4.1.

The qualitative proven conceptual model shows the four DCs, their interrelationships and impacts on performance outcome variable (RRs), as well as their effects on the resource base. All proposed relationships between the constructs could be confirmed by the qualitative data. In distinction from the initial model, the (refined) conceptual model presented in Figure 4.1 does not explicitly specify the variables of resource quality and resource diversity anymore, as interviewees had difficulties in differentiating between knowledge breadth and depth. Hence, in order to reduce complexity of the model, but at the same time not to lose any substance of content, both knowledge breadth and depth are applied in the quantitative research to evaluate the quality and diversity of Market Knowledge and Technological Knowledge, respectively, but are not assessed as separate constructs. The original hypotheses H1a and H1b were therefore omitted from the model and are not being tested separately anymore, as they where (already) included in H1 and H1 (1) (refer to chapter 3.6.2, Table 3.2).

Figure 4.1 Qualitatively proven Conceptual Model



* Comprising diversity and quality of Market Knowledge (measured by Market Knowledge breadth and depth)
** Comprising diversity and quality of Technological Knowledge (measured by Technological Knowledge breadth and depth)

Source: own illustration

As a result, the qualitative data analyses contributed to a specification of the conceptual model, which could be confirmed by the interviewees and subsequently will be tested in the quantitative research step. Therefore the propositions developed based on the literature review and confirmed by the qualitative research will be tested in the quantitative research step. The following chapter 5 first describes the quantitative research methods applied, while chapter 6 presents the results of the quantitative analyses.

Chapter 5: Quantitative Research: Questionnaire Design and Data Collection

5.1 Introduction

Following the introduction and discussion of the general research design and the presentation of the results from the qualitative research, this chapter specifies the quantitative research method applied for testing the conceptual model and hypotheses. The chapter starts with a critical examination of the data collection method, a self-administered online survey, chosen for the quantitative research part, and justifies its use. This is followed by a discussion of the questionnaire design, which incorporates the levels of measurement, theory and statistical analysis, an operationalisation of the measurement constructs and scales used, as well as the pre-test of the survey instrument. The last section describes the data collection process outlining the sampling procedure, frame and size, as well as nonresponse bias.

5.2 Quantitative Research Method

As briefly introduced in chapter 4.2.2., a survey was chosen as appropriate data collection method for the quantitative analysis of the model and hypotheses. The decision was made based on the following considerations. Generally, surveys are seen as valuable instrument, commonly used in research practice, when the aim is to collect quantitative data for statistical analysis from a variety of different respondents in a cost- and time-efficient manner (Kinnear et al., 1993, Veal and Ticehurst, 2005, Zikmund, 2003, Lukas et al., 2004, Page and Meyer, 2000). This is faced by the critics of a lack of control over the respondent and lack of knowledge whether the answers given are reliable and faithful, generally rather low response rates, and a high reliance on the survey design (Plewa, 2010 referring to Lukas et al., 2004). Moreover while different survey channels exists, including personal (face-to-face), phone, fax, mail or online surveys, "the appropriateness of one type or channel for a particular study may be based on several factors, such as the versatility, cost, time, sample control, quantity of data, quality of data and response rate" (Plewa, 2010, p. 81, referring to Klassen and Jacobs, 2001).

For this research a self-administered online survey was deemed the most appropriate instrument due to the following weighting of advantages and disadvantages. It is commonly agreed that one disadvantage of web-based surveys is the potential misconception of questions by the respondents, as the respondents are not in direct communication with the researcher (Lukas et al., 2004). Although the possibility is given to all respondents to contact the researcher in case any questions occur, not always are the respondents aware of a misconception, and in case they are it is more likely for them to leave the question unanswered (Plewa, 2010). This generally leads to lower item completion rates in online surveys (Klassen and Jacobs, 2001).

As opposed to this, common advantages of online surveys are, first, the low costs for the online survey to be set up, as no printing or postage of the questionnaires arises (Aaker et al., 2004, Lukas et al., 2004). Second, online surveys allow a high degree of flexibility in responding, as the participant can answer the questions at their own time (Plewa, 2010), thus leading to a high level of accuracy of measurement (Aaker et al., 2004, Zikmund, 2003). This was regarded as especially relevant for this study as the target respondents, being industrial representatives in middle and upper management positions, are often impaired by time constraints. Third, online surveys are regarded as preferable instrument when concerned with sensitive topics (Aaker et al., 2004). Entailing questions regarding the firm's capabilities and resources, this also includes aspects such as the evaluation of internal capabilities against competitors, hence the topic in this survey are likely to be viewed as sensitive by respondents. Fourth, although the response rate of online surveys is found to be lower than in face-to-face surveys (Lukas et al., 2004), a comparatively high response rate was ensured through a specific targeting in the sampling procedure supported by an professional panel service provider.

Hence, an email-distributed online survey was assessed as most appropriate method for this study, considering the costs and target sample pool available for this research. Moreover, using the online survey tool *Unipark*, the data gathered by the respondents could be directly exported into the statistical software *SPSS*, which ensured accuracy of data processing. Besides, by means of controlling for the IP address, respondents that had already completed the survey could be disclosed from entering a second time.

5.3 Questionnaire Design

The following section elaborates on the questionnaire design, which has to be based on a deep understanding of the research topic and questions to be addressed in the study (Veal and Ticehurst, 2005). The conceptual model and hypotheses, developed in chapter 3 and specified in chapter 4, already indicated the relevant constructs for this study and the proposed associations between those constructs. Based on these findings a questionnaire was developed for the data gathering phase. Adapting a step-by-step procedure (Veal and Ticehurst, 2005, Plewa, 2010), first the levels of measurement, theory and statistical analysis were defined, second a specification of the nature of constructs (whether they were formative or reflective) was provided, thereafter the constructs were operationalised and measurement scales determined. Finally, the questionnaire was pre-tested and revised, as described in the following section.

5.3.1 The Levels of Measurement, Theory and Statistical Analysis

Prior to the development of the questionnaire the unit of analysis has to be defined (Zikmund, 2003) and the levels of measurement, theory and statistical analysis have to be clarified (Currall and Inkpen, 2002).

First, the **level of measurement** defines the sampling unit, that is to say the source of the data. For this study a key informant approach was utilised (Patterson and Spreng, 1997), collecting data on a personal measurement level, with upper and middle managers being the key respondent. While there is an ongoing debate on its appropriateness, previous research showed that "a single key informant can provide reliable and valid information on a personal level as well as higher levels of theory" (Plewa, 2010, p. 79).

Second, the **level of theory** determines the unit that the study intends to examine and generalises on (Klein et al., 1994). In this study DCs, Resources, and RR are measured at the firm level, hence the study´s unit of analysis is the firm. A review of publications showed that DCs and knowledge based resource are often operationalised on the individual level (Hawass, 2010) or the group level (Pavlou and El Sawy, 2011[15]), namely research group and business unit, whereby only few publications exist, that assess them on the firm level. This study aims to examine interrelations between capabilities, resources and RR at the firm level, therefore not an individual research group or business unit is examined, but the DCs are measured for the whole company.

Third, the **level of analysis** describes the statistical treatment of data (Klein et al., 1994). The firm level was also regarded as the appropriate level of analysis for all constructs. Respondents hence were asked to report on their firm`s level of DCs, resources and RR success.

Briefly it can be said, that the level of analysis is aligned with the level of theory. The prevalent level of theory and analysis in this research is the firm level, hence only one level of measurement, theory and analysis is incorporated in the model and utilised in this study.

5.3.2 Formative vs. Reflective Measurement Models

Prior the development of the measurement scales a specification of the nature of constructs used in the study, whether they are formative or reflective in nature, is needed. Latent variables are theoretical constructs which a priori cannot be directly measured and thus have to be assessed by indicator variables, also called manifest variables, which in term are observable (Diamantpopoulos et al., 2008). To display the causal relationships between the latent constructs in a structural path

[15] In their study Pavlou and El Sawy (2011) focus on the group level, explicitly the NPD unit`s attributes, not the firm`s attributes are addressed.

model, previously they need to be operationalised in a measurement model, which describes the causal relationships between the latent constructs and its indicator variables (Eberl, 2004). Hereto, latent constructs are usually operationalised through multiple observable indicator variables to prevent them from being biased by single measures (Homburg and Dobratz, 1991). Generally two different forms of operationalisation of measurement models regarding the causality (direction) of the relationships between construct and indicators can be distinguished: *reflective* measurement models (from construct to indicators) and *formative* measurement models (from indicators to construct) (e.g. Edwards and Bagozzi 2000, Dimantpopoulos et al., 2008). While the distinction is not new, it received increased attention in the last years, where a debate raised on the correct operationalisation of latent constructs, especially as still deficits exist regarding the use of formative indicators for construct measurement (Albers and Hildebrandt 2006, Jarvis et al., 2003, Diamantpopoulos et al., 2008). Hence in recent years, formative models receive increasing attention, however its use in empirical studies is still scarce, and despite its appropriateness for operationalisation of specific constructs, its applications is still neglected in many cases in favor of reflective models, leading to high rates of misspecifications (Jarvis et al., 2003, Fassot and Eggert, 2005, Podsakoff et al., 2006).

Reflective measurement models have a long tradition in social science, its fundamental characteristic is that the latent construct 'causes' or 'reflects' its indicator, hence "a change in the latent variable causes variation in all measures simultaneously […, and] all measures in a reflective measurement model must be positively intercorrelated" (Dimantpopoulos et al., 2008, p. 1240). Accordingly measurement items represent manifestations of an underlying latent construct (Bollen and Lennox, 1991). Due to the required high correlations among the indicator items, the items are interchangeable, meaning that the elimination of one item would not change the nature of the underlying construct (Bollen and Lennox, 1991, Diamantpopoulos and Winklhofer, 2001). This implies that the quality of measurement is not necessarily affected by the elimination of single items, as all facets of the latent construct might be represented by the remaining indicators (Jarvis et al. 2003).

Formative measurement models by contrast, assume that the latent construct is 'caused' or 'formed' by its indicators, hence "the indicators determine the latent variable which receives its meaning from the former" (Dimantpopoulos et al., 2008, p. 1241). The latent construct hence is defined as a linear sum of a set of measurement items that build the construct (Bagozzi, 1994). Given this causal direction each indicator captures a specific aspect of the latent construct. Hence formative indicators can be regarded as a 'set of distinct causes' (Jarvis et al. 2003), whereby each indicator represents a unique input, therefore indicators are not interchangeable, and thus allowed to be (positively, negatively or not at all) correlated among each other (for a detailed discussion see

Bollen, 1984). For this reasoning and opposed to reflective models, internal consistency of the constructs is not presumed for formative models (Bollen, 1984), likewise it is difficult to assess reliability and construct validity for formative constructs (Bagozzi, 1994, Bollen and Lennox, 1991, Jarvis et al., 2003). Hence, for the operationalisation of formative models more important than achieving commonly used quality criteria for validity and reliability of the measurement, is to capture the entire range of distinct inputs to build the latent variable (Diamantopoulos and Winklhofer, 2001). On the other hand an elimination of a single item in a formative model would lead to a sacrifice of content validity.

To avoid misspecification prior any empirical investigation, the nature of the indicator variables and thus constructs needs to be specified a priori as it needs to be aligned with the questionnaire design (Jahn, 2007). To determine the nature of constructs, decision rules were followed as presented by Jarvis et al. (2003), which were based on the characteristic of formative and reflective models as outlined above. The results lead to the majority of constructs used in this research being conceptualised as reflective constructs, implying that the specific constructs (e.g. DCs) are reflected through its measurement items. Only RR was conceptualised as a second-order formative model, formed by different distinct types of RR. As detailed below, in this case a formative model was more appropriate than a reflective one. The operationalisation of the constructs is detailed in the following.

5.3.3 Operationalisation of Constructs

The operationalisation of the constructs used in this research required the identification or development of appropriate measurement instruments. This comprises, the decisions about whether existing scales can be used for this study, moreover whether an adaptation of these scales is required to suit this research context, or whether measurement instruments needed to be newly developed following standard scale development procedures (Page and Meyer, 2000). Whenever suitable, measurement items were adapted from existing, validated scales identified in the available literature. All scales used were adapted to the studies level of analysis (the firm level), and phrased relative to competitors. Based on a discussion and justification of the operationalisation of constructs, the measurement scales used in this study are presented in the following sections. The final questionnaire and the individual measurement items applied to measure each construct are provided in Appendix 5.1. Items followed by [R] are reverse coded.

Dynamic Capabilities

Due to the lack of empirical research on the DC construct, only few studies exist that discussed different ways for the operationalisation of DCs (Pavlou and El Sawy, 2011, Barreto, 2010), all of them have conceptualised the construct as a "second-order formative" or "aggregated multi-dimensional construct" that is formed out of its individual dimensions. As this research aims to shed light on the individual dimensions of DC, as Sensing, Learning, Integrating and Coordinating capacity are proposed to take different roles and effects in the process of resource value creation in firms, however this study refrains from regarding DCs as a simple „sum of its dimensions", forming an overall DC out of the single dimensions. Thus, in this study DCs are not conceptualised as a multi-dimensional (second-order formative) construct, but rather measured as individual first-order reflective constructs.

Given this conceptual understanding of DCs as distinct constructs, the scales developed by Pavlou and El Sawy (2011) to measure Sensing, Learning, Integrating and Coordinating capacity were used in this research. However the original scales needed to be adapted to this research`s understanding of the firm`s DCs as developed in chapter 3, hereto most of the measurement items were adapted from the original scale, some items were partially modified and contextually respecified, while other were added to the scale. Following standard scale development procedures the modified scales were tested in a separate pre-test (refer to chapter 4.3.1 and Appendix 4.1) before being used in the quantitative survey. All DCs were measured at the firm level. Respondents were asked to rate their firm`s capacities in different areas relative to their major competitors. Using a seven-point likert scale (1 = I strongly disagree, 7 = I strongly agree) respondents were asked to indicate for each statement the extent to which it describes their firm (refer to Appendix 5.1, section A).

Sensing Capacity refers to the generation of market intelligence, customer and competitor intelligence, and technological intelligence and was measured based on the work by Pavlou and El Sawy (2011). Sensing capacity was operationalised by six reflective items as presented in Appendix 5.1, section A, whereby the first three items were taken from the original scale by Pavlou and El Sawy, while V0804, V0805 and V0806 were added to the original scale to further address technological orientation, responsiveness to industry trends and competitor activity. The new items were based on Teece (2007).

Learning Capacity captures the acquisition, assimilation, creation and retention of (new) knowledge. The operationalisation of the construct was based on the scale developed by Pavlou and El Sawy (2011), whereby three items (V0901, V0903, V0906) were taken from the original five-item scale, while the other two items used to capture Realised Absorptive Capacity (RACAP) were disclosed for the reason that Learning capacity as defined in this research comprises Potential Absorptive Capacity (PACAP) and Knowledge Creation, but not RACAP (referring to Zahra and George, 2002). Instead three items were added to the original scale that addressed the extent to which a firm uses processes and routines for Knowledge Acquisition (V0902), Knowledge Codification (V0904) and Knowledge Retention (V0905) to acquire, capture and renew knowledge (refer to Appendix 5.1, section A). The conceptualisation of these new items was informed by the Exploratory and Transformative Learning scales developed by Lichtenthaler (2009).

Integrating Capacity captures the contribution, representation, and interrelation of individual input to the entire business following Pavlou and El Sawy (2011). Seven items were used to measure Integrating capacity. Two items (V1001, V1002) were taken from the original scale developed by Pavlou and El Sawy (2011), while four items were added to the original scale (see Appendix 5.1, section A). The new items were informed by previous studies by Menon et al. (1997), Jaworski and Kohli (1993), Morgan and Piercy (1998) and De Luca and Atuahene-Gima (2007), used to capture firm`s routines and processes directed towards intra- and interdepartmental integration as well as cross-functional integration. Hence the items incorporated the level of interorganisational integration during the entire process, the frequency of interaction between groups and departments and the level of cross-functional team effort.

Coordinating Capacity captures resource allocation, task assignment, and synchronisation referring to Pavlou and El Sawy (2011). Therefore all items were taken from the original five-item scale by Pavlou and El Sawy (2011) and extended by one additional item (V1105), which was added to ensure the correct and comprehensive measurement of efficiency of resource and knowledge exploitation routines to incorporate the original thoughts by Teece (2007) (refer to Appendix 5.1, section A).

As DCs are abstract, intangible, not directly observable, thus latent constructs, it was deemed valuable to use these multiple reflective indicator items to measure each dimension-related construct (Pavlou and El Sawy, 2011, Barretto, 2010). As can be seen from the conceptualisation of the items, the constructs are reflective in nature as each construct (e.g. Sensing capacity) causes its items (e.g. we frequently scan the environment to identify new business opportunities). Accordingly, the items are regarded as manifestations of the construct. It should be noted however, that while the DCs are being conceptualised as distinct constructs, they may still be weakly correlated, and interdependences may exist (Pavlou and El Sawy, 2011) (as outlined in chapter 3.4.1.6).

Characteristics of the Resource Base

To evaluate the potential value of the resource base, different characteristics of the resources base were assessed. This research differentiates between Market and Technology Knowledge. **Market Knowledge** refers to the firm’s understanding of the market environment, particularly of customers and competitors (e.g. De Luca and Atuahene-Gima, 2007), while **Technological Knowledge** refers to the firm`s technological expertise, R&D as well as engineering skills and competences (e.g. De Luca and Atuahene-Gima, 2007). In line with De Luca and Atuahene-Gima (2007) and opposed to other studies (e.g. Atuahene-Gima, 2005, Li and Calantone, 1998, Narver and Slater, 1990, Danneels, 2007, Wiklund and Shepherd, 2003) that differentiate between different sub-types of Market Knowledge (e.g. customer and competitor knowledge) and Technological Knowledge (e.g. technical, R&D, engineering knowledge), for this study a holistic measurement approach to the concept of Market and Technological Knowledge was chosen as appropriate means in order to reduce the complexity of the measurement model for the informants. This approach was justified following the argument by De Luca and Atuahene-Gima (2007) stating, that the characteristics of knowledge are the same for customers and competitor knowledge, respectively for technical, R&D, engineering knowledge, and therefore no theoretical rationale is given to expect differential effects of the different sub-types of Market and Technological Knowledge on RR (see De Luca and Atuahene-Gima, 2007, p. 101). For this reason an aggregated measure of Market Knowledge and Technological Knowledge was chosen. However, to ensure a consistent understanding of Market and Technological Knowledge in the survey their definitions were included in the questionnaire. Given a common understanding of the terminology, respondents were asked to refer to the different characteristics of their firm`s Market and Technological Knowledge, hereto they were asked to evaluate their Market and Technological Knowledge *breadth and depth*, thereafter *knowledge tacitness*, *knowledge specificy, knowledge complementarity* and *knowledge origin*.

Market and Technological Knowledge Breadth is defined as the number or range of different knowledge areas the firm is familiar with (De Luca and Atuahene-Gima, 2007, Bierly and Chakrabarti, 1996). Different measures can be found in the literature for the knowledge breadth. Based on the work by Gupta and Govindarajan (2000), Wiklund and Shepherd (2003) present a comprehensive measurement scale of the firm`s procedural knowledge by means of evaluating 11 different knowledge domains measuring a firm`s knowledge position compared to companies in the industry. While the scale is highly comprehensive in terms of its scope, however, it does not offer a clear differentiation between the Market and Technological Knowledge areas. Other more objective measures for knowledge breath exists, as to name total number of patents (Henderson and Cockburn, 1994), number of technologies (Pavitt, 1985), multi-technologicalness (Granstand and Sjölander, 1988), technical diversification (Granstand and Sjölander, 1988), knowledge heterogeneity (Rodan and Galunic, 2004), however a big penalty of all those measures is, that an exact assessment of knowledge by numbers is highly dependent on the level of abstraction and granularity used, hence comparability between firms is difficult to reach (Granstand and Sjölander, 1988). Accordingly Rouse and Daellenback (1999) claim that the "major reason for the scarcity of empirical studies lies in the difficulty of identifying the core resources that firms can use to gain a competitive advantage" (Zahra and Wiklund, 2002, p. 33). To overcome these restrains, in this research the scale originally developed by Zahra et al. (2000) and adapted by De Luca and Atuahene-Gima (2007) was used, for its benefits of its simplicity and coherence, reliability and validity, and suitability for measuring both Market

Knowledge breadth (De Luca, 2007) and Technological Knowledge breadth (Zahra et al., 2000). Respondents were asked to evaluate their firm`s Market and Technological Knowledge on a continuum from “limited” to “wide ranging” and “narrow” to “broad” (refer to Appendix 5.1, section B).

Market and Technological Knowledge Depth is defined in this study as the level of sophistication and complexity of the firm`s knowledge in a specific area (De Luca and Atuahene-Gima, 2007), referring to the depth and quality of learning (Zahra et al., 2000). Likewise knowledge breadth different measures can be found in the literature for knowledge depth. Danneels (2007) for example provides a good measurement example of the propensity to change the resource base, looking at market resource accumulation and technology resource accumulation, and asking to what extend a company build or developed new resources that it did not have three years ago. However, this scale only measures the extent or quality of new knowledge-based resources, independently of the existing knowledge base in the company. For the same reasons as mentioned above (simplicity, reliability and validity of the scale), Market and Technology Knowledge depth was measured using the scale developed by Zahra and colleagues (2000) and adapted by De Luca and Atuahene-Gima (2007). Accordingly Market Knowledge depth was measured on a semantic-differential scale asking the respondents to evaluate their firm`s Market and Technology Knowledge on a continuum form “basic” to “advanced”, and “shallow” vs. “deep” (refer to Appendix 5.1, section B).

Knowledge Tacitness is nowadays a familiar category for knowledge and an established construct in organisation theory, and was included as a further characteristic of the resource base. Knowledge Tacitness, as conceptualised in this research, focuses on the transferability and codification of knowledge. Hence, items by De Luca and Atuahene-Gima (2007) going back to Szulanski (1996) were deemed suitable for this research and used to operationalise knowledge tacitness. Knowledge tacitness thus was measured with four items (refer to Appendix 5.1, section B), capturing the extent to which the firm`s knowledge is formally documented, codified and communicated through written reports, and hence transferable (Szulanski, 1996). This measurement reflects the embedded nature of knowledge in firms.

Knowledge Specificy refers to “the extent to which the firm’s knowledge is tailored to the requirements of specific contexts in which it is maximally effective but loses its value in other contexts” (De Luca, 2007, p. 98). This study operationalised knowledge specificy based on the scale developed by De Luca and Atuahene-Gima (2007), going back to Reed and De Fillippi (1990). Their three items reflect the extent to which the Market and Technological Knowledge is tailored to the firm`s environment. One additional item (V1604) was added measuring knowledge specific from a different perspectives capturing the generalisability of knowledge, hence this item was conceptualised as reverse coded (refer to Appendix 5.1, section B).

Knowledge Complementarity refers to the level to which the areas of knowledge available in the firm complement each other. The requirement for a generic knowledge complementarity measure as well as the peculiarity of the research field limited the usability of existing scales for this research. A range of scales are available in literature, most of them were found as too specific in terms of measurement, focusing primarily on the specific characteristics of products and their complementarity, resource modularity (Sanchez, 1995, Sanchez and Mahoney, 1996), or complementarity of alliance partners (Lin et al., 2009). The study by Song et al. (2005) is the only study, that empirically investigated resource complementarity in regard to Market and Technological resources, however, in this study resource complementarity was not directly measured, rather it was conceptualised as a simple interaction term build through Market and Technological Knowledge. Other studies were found as too restrictive due to the specificity of dimensions regarding the research area or field. Hence, due to the lack of existing scales, an own scale comprising three items was developed and pre-tested (refer to Appendix 5.1, section B).

Knowledge Origin in this study refers to the degree to which the resources available within the firm`s resource base consist of externally acquired resources or have already been internally existent. Knowledge origin was conceptualised as a one-item measure, asking respondents to rate on a scale from 0% to 100%, how much of their knowledge is internally based (existing) and how much is externally acquired (new). To ensure a consistent understanding of the terminology, a definition was enclosed in the survey. All constructs measuring the characteristics of the resource base were operationalised as reflective constructs, an overview of all items is given in Appendix 5.1, section B.

Outcome Variable: Resource Recombination

RR was conceptualised as a multidimensional formative construct that is a composite variable formed by four different types of RR. The conceptualisation of multidimensional constructs necessitates a distinction between two levels of analysis, the first level relates the indicator variables to the (first-order) dimensions, while the second level relates the individual dimensions to the (second-order) latent construct (Diamantpopoulos et al. 2008).

Thus, in contrast to all other constructs used in this research which are conceptualised as first-order reflective constructs, RR is formed by the four different types of RR and thus conceptualised as a second-order formative construct. Following Lee and Cardogan (2013) alternatively to building multiple independent first-order reflective constructs (refer to Model A in Figure 5.1), researchers can compute a higher-order constructs by using the first-order (reflective) constructs $\xi 1$, $\xi 2$, $\xi 3$ to build the formative latent construct $\eta 1$ (refer to Model B in Figure 5.1). Figure 5.1 gives a graphical notation of first-order reflective models and its alternative use in a second-order formative construct.

Figure 5.1 A first-order reflective Measurement Model and its alternative Specification

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Source: Lee and Cardogan, 2013, p. 245

Modelling RR as a formative, aggregated measure is justified in this research following the argument by Cenfetelli and Bassellier (2009, p. 690), stating that “formative measurement simplifies what might otherwise be multiple paths in a structural model into a more concise single path (…) [between the exogenous construct and the endogenous] formatively measured construct. Such bundling of indicators enhances parsimony through the substitution of a single construct in place of multiple indicators within a theoretical model.” While there is an ongoing discussion of the appropriate usage of formative models in SEM (e.g. Diamantopoulos et al., 2008, Diamantopoulos and Siguaw, 2006), being conscious of its constraints as detailed discussed by Lee and Cardogan (2013), for this research its usage is regarded as a sufficient way of aggregating first-order constructs into higher-order constructs in regard to reduce the complexity of the research model.

The operationalisation of multidimensional constructs involves both the conceptualisation of the second order formative construct as well as the measurement of the dimension-related first order reflective constructs (each of the four types of RR) (Barreto, 2010). The formative model was build consistent with the guidelines presented by Diamantpopoulos and Winklhofer (2001): (i) specifying the content domain of the second- and first-order constructs, (ii) proposing the effects of the first-order on the second-order construct, (iii) specifying the relationships and distinctions among the first-order constructs, and (iv) proposing the role of the second-order construct on the study’s dependent variables (Pavlou and El Sawy, 2011, p. 252).

Other than a second-order *reflective* model would assume, the construction of second-order *formative* models as presented in Figure 5.1 does not require the **first-order (reflective) constructs** to be conceptually identical (Lee and Cardogan, 2013). Rather more, the first-order reflective models can be theoretical distinct entities that represent different facets of the overall construct. In this research, as explained earlier, each of the four types of RR is distinct from each other, with every type of RR offering a unique component to the overall RR in firms. The resulting formative model of RR thus represents a measurable model that can be used to capture RR through the four underlying components. Therefore a formative multidimensional construct revealed appropriate for the construction of RR in this research.

In line with the conceptualisation of RR provided in chapter 2.4.2.2, the RR measures applied in this study focus on the deployment of *existing* versus *new resources* for *ongoing* versus *new business initiatives* to create new products or services, as defined by Zahra and Wiklund (2002). The first-order reflective constructs, used to measure the four different types of RR, were conceptualised based on the scale developed by Zahra and Wiklund (2002) and applied by Wiklund and Shepherd (2009), and were adopted to this research`s context, due to the lack of alternative reliable and valid measures for RR in literature. The measures were conceptualised to focus on the extent to which firms are engaged in distinct RR activities. For all four types, respondents were asked to indicate their agreement with different statements with respect to the four different types of RR (refer to Appendix 5.1, section C). In all cases, instruction reads as follows: "Often innovation is seen as the recombination of resources in new ways to create new, innovative products or services. We differentiate between 4 types of Resource Recombination (as described in Appendix 2.2) according to their usage of EXISTING vs. NEW RESOURCES for ONGOING vs. NEW BUSINESS INITIATIVES (definitions were provided). The following questions ask you to what extent your company focused on different types of Resource Recombination over the past 3 years and compared to the common practice in your industry."

Type 1 RR: Existing Resources for Ongoing Business Initiatives

Following Zahra and Wiklund (2002, p. 22) this type of RR is defined as "the reconfiguration of a firm's [existing] resource inputs to make their use more efficient". It was measured by four items developed by Zahra and Wiklund (2002), capturing th*e "*re-deployment of a business' current resources to add features to existing products, or expand service offerings" (Wiklund and Shepherd, 2009, p. 200) in order to achieve objectives more economically or more efficiently (Zahra and Wiklund, 2002). Minor specifications in the wording were made to avoid ambiguity. A high score in this index would give evidence that the firm places great emphasis on this type of RR.

Type 2 RR: New Resources for Ongoing Business Initiatives

Following the definition by Zahra and Wiklund (2002, p. 23) and Wiklund and Shepherd (2009, p. 200) type 2 of RR refers to the "infusion of new resources to improve efficiency, increase product variety, add new features to existing products, and enhance performance in new arenas". Type 2 RR was measured by four items based in the original scale developed by Zahra and Wiklund (2002) whereby small adaptions of the wording were made. According to the measures a high score in this index would give evidence that the firm places great emphasis on this type of RR.

Type 3 RR: Existing Resources for New Business Activities

In line with Zahra and Wiklund (2002, p.23) and Wiklund and Shepherd (2009, p. 200), this type of RR refers to "changing of the firm's mix of resource inputs to pursue new initiatives such as extending the new product line, introducing new products, or entering new markets". Type 3 of RR was conceptualised based on the scale developed by Zahra and Wiklund (2002). Their four items reflect the emphasis given by the firm to this type of RR.

Type 4 RR: New Resources for New Business Activities

Following the definition presented by Zahra and Wiklund (2002, p.23) this type of RR refers to "the acquisition and use of these resource inputs to generate new products, goods or services for new markets." In line with the other measures type 4 of RR was conceptualised based on the six-item-scale developed by Zahra and Wiklund (2002), however to reduce complexity only four items were applied in this research, reflecting the firm`s emphasis given to this type of RR.

The scales used to measure each single type of RR (as first-order reflective construct) are presented in Appendix 5.1, section C. Having built the first-order reflective constructs, these models were used in a second step to form the **second-order formative** construct of RR. The aggregation heuristic used for the calculation of the second-order construct is detailed in the data analysis chapter 6.4.7. Additionally for identification purposes, an overall measure of RR was developed and included in the questionnaire, assessing RR through four (direct) indicator items (see Appendix 5.1, section C). The reason for additionally measuring second-order constructs with these (direct) indicator items is to cross-validate that the indirect measurement through the first-order dimensions (Types of RR) is also consistent with their (direct) indicator items (e.g. Pavlou and El Sawy, 2011).

Antecedents: Networking Orientation and Entrepreneurial Orientation

Networking Orientation and Entrepreneurial Orientation were included as antecedents to DCs in the model (refer to Appendix 5.1, section D and G).

Networking Orientation in this research is conceptualised as "the extent to which a firm's business strategy stresses effective and efficient location of network partners, management of network relationships, and improvement of network performance" (Mu and Di Benedetto, 2011, p. 341). The construct was measured using the original scale developed by Mu and Di Benedetto (2011), which based their scale on an extensive theoretical review on social network and new product development literature (e.g. Dyer and Singh, 1998, Ahuja, 2000, Gulati et al., 2000, Moran, 2005).

Respondents were asked to indicate for each statement the extent to which it describes the firm`s orientation towards collaborating with external partners (i.e. suppliers, customers, institutions) on a seven-point likert scale (1 = I strongly disagree to 7 = I strongly agree).

Entrepreneurial Orientation, regarded as a combination of *innovativeness*, *proactiveness*, and *risk-taking* (e.g., Wiklund, 1999), reflects the extent to which firms establish the identification and exploitation of untapped opportunities (Lumpkin and Dess, 1996, Baker and Sinkula, 2009). EO was measured applying the established scale developed by Baker and Sinkula (2009) going back to Covin and Slevin (1989) and refined by Naman and Stevin (1993). The scale is widely accepted and used in research practice (e.g. Wiklund and Shepherd, 2003), as items are regarded as good conceptualisation of the three key-dimensions of EO. Pairs of statements were given to the respondents, which represent opposite ends. They were asked to mark on a semantic differential scale the number which best represents the view of their firm. To avoid response bias and control for correctness of answer the last three items were reverse coded.

Control variables

The study also controlled for a number of variables, which deemed to be important determinants that might affect the hypothesised relationships, including *environmental turbulence, company size, company age, position, functional area,* and *industry sector* (whether the company was acting in an industry or service sector), and *R&D intensity*. The measures were drawn from related research on value creation in firms (e.g. Isobe et al., 2008, Pavlou and El Sawy, 2011, Wiklund et al. 2002). The individual items used to measure the control variables are provided in Appendix 5.1.

Environmental Turbulence was measured with the five-item-scale as developed by Atuahene-Gima (2005) (see Appendix 5.1, section E) to capture the pace of change and uncertainty in the environment that arises through changing customer needs and technological volatility (Isobe et al., 2008). The variable was included in the model to control for the likely effect of uncertain and unpredictable environments on the development of DCs and RR in firms as suggested by the DC perspective (e.g. Teece et al., 1997, Brown and Eisenhardt, 1997).

Company Size was assessed by the firm`s total number of employees (e.g. Isobe et al., 2008, Pavlou and El Sawy, 2011, Wiklund et al. 2002). The variable was included to test for the potential effect of company size on RR in firms, as a variety of studies indicate that well-established, big companies might possess advantages in terms of availability of resources, while at the same time smaller companies might possess a higher flexibility to refine their asset structure (e.g. Isobe et al., 2008), both of which might influence RR in firms. The central view represented in the literature is that older and larger firms are less adaptive or flexible and therefore less capable to change their resource base (Danneels, 2008).

Company Age was measured by the number of years a venture had been in existence (Zahra et al. 2000) and assessed by asking respondents to report the year in which the company was founded (e.g. Isobe et al., 2008, Zahra et al. 2000). Age might influence a firm's technological learning (Zahra et al. 2000), as resource accumulation is the result of a variety of path-dependent processes of investment, sensing, learning and decision-making (e.g. Teece et al. 2007), thus processes that firms adopt over time (Dierickx and Cool, 1989). Hence, following Isobe et al. (2008, p.416), it might be suggested that "as a result of this path dependence, firms tend to confine themselves to a limited set of technological domains and lose flexibility in their ability to respond to environmental change". Thus company age might have an influence on RR, in a way that older firms are less flexible and effective in developing new RRs than younger.

Functional Area was controlled for by asking respondents to specify their core functional area, whether it is (1) General Management, (2) Innovation Management, (3) Product Development Management, (4) Business Development Management, (5) R&D, or (6) Others (whereby the latter group of respondents were screened out as they were not in the target sample, refer to 5.4). This variable was included to test if the right target sample was reached and moreover to control if different evaluations of the studies` constructs dependent on the functional area of the respondent (e.g. whether the respondent yield a general management function or a specialist function). The same accounts for the **current position** of the respondent. Here the respondents were asked to indicate their current position (e.g. whether the respondent was in the upper or middle management). The responses were coded as a dichotomous variable, with 0 for upper management and 1 for middle management.

Industry Segment was controlled for based on the UK Standard Industrial Classification (SIC) Scheme (2007). Respondents were asked to refer to the industry sector their firm is working in (defined in the survey as the one from which the company generates most of its turn-over) based on a 2-diget SIC code (whereby relevant information on the UK SIC Scheme was provided in a separate pdf-document). As industries vary in their technological opportunities and ability to induce learning (Li, 1995), R&D expenditure (OECD, 2011), and resource profitability (Brown and Garten, 1994), the variable was included to test for the potential effect of different industry sectors (e.g. high tech vs. low tech industries, manufacturing vs. service sector) on RR in firms.

Ownership Structure was assessed by asking respondents, whether their firms was a (1) public company (listed on stock exchange), (2) private company (ownerships by CEO and family), (3) family-owned company (ownerships by family), or (4) others, which they were asked to specify (similar to Zahra and Wiklund, 2002, Zahra et al. 2002). Differences between independent and corporate-owned companies were reported in regard to their strategic choices and technological strategies (e.g. Zahra, 1996). The variable was included in order to test the likely effect that private or family-owned businesses might have different control-mechanisms in respect to decision making processes than corporate-owned companies (Bell, 1991). This is as "managers of corporate-owned ventures often have limited discretion to initiate strategic changes such as revising the mix of their companies' resources or the way these resources are combined. Such changes often require corporate approval, which can induce conservatism" (Zahra and Wiklund, 2002, p. 26). Hence a positive relationship is expected between a private or family owned company and RR. The responses were coded as a dichotomous variable, with 0 for independent firms and 1 for corporate units.

R&D Intensity defines the R&D expenditures as a percentage of sales, and was employed in this study as commonly accepted indicator for technology-intensiveness and thus innovation-activeness of firms, respectively industry sectors (OECD, 2011). The logic behind is that, "firms which are technology-intensive innovate more, win new markets, use available resources more productively and generally offer higher remuneration to the people that they employ" (Hatzichronoglou, 1997, p. 4). Therefore, the OECD uses R&D intensity as indicator to classify manufacturing industries in „high‟, „medium-high‟, „medium-low‟ and „low" technology industries (OECD, 2011). In line with previous studies (e.g. Pavlou and El Sawy, 2011), in this research R&D intensity was measured by the percentage of sales spent on R&D. The variable was included to control for the likely effect of R&D intensity on RR. Beside it was used to test if the right target sample was reached and to cross-validate the data by correlating it with the industry segment data. Strong approval between the two information sources and data provided by the respondents obtained. Notably, as R&D intensity as an indicator for technology-intensiveness allows inferences about the firm`s innovation-activeness of the industry, however, it is not always suitable for service industries. Instead, for service industries other indicators as skill intensity or indirect R&D measures, such as technology embodied in investment or investment in ICT goods are more suitable (OECD, 2011). Due to the lack of readily accessible scales to gather that information, the percentage of R&D expenditure was taken as a proxy.

Innovation Performance was additionally included in the questionnaire to allow testing the established effect of RR on innovation performance. Innovation performance as conceptualised in this research entails both strategic performance (product effectiveness) and operational efficiency (process efficiency) (e.g. Isobe, 2008, Pavlou and El Sawy, 2011), and was measured based on the scale developed by March and Stock (2006). As March and Stock`s scale was originally developed in the context of new product development, their items were adapted to this studies` context (product and service innovation). To complement the strategic performance measures, the scale was further extended by two additional items used to measuring operational efficiency as developed by Isobe et al. (2008). Hence, overall innovation performance was measured with six items that asked respondents to indicate the extent to which the firm has achieved its objectives regarding innovation performance formed by strategic performance and operational efficiency (see Appendix 5.1, section F). Consistent with Pavlou and El Sawy (2011), this operationalisation places weights on both dimensions of innovation performance, and thereby captures that firms are encouraged to handle both efficiency and effectively, rather than focusing on one dimension over the other (Sethi, 2000).

In summary, the overall questionnaire entailed 98 items to measure the exogenous and endogenous constructs used in the measurement model, among those 24 items for measuring the DCs, 20 items for measuring the characteristics of the resource base, 22 items measuring for the RR construct, 14 items for measuring the antecedents, and another 18 items for measuring the controls. Details of the individual items that were used to measure each construct are provided in Appendix 5.1.

5.3.4 Measurement Scales

Closely linked with the operationalisation of the constructs is the decision about the appropriate measurement scales, used to measure the differentiating values of the respondent`s answers. Generally a distinction can be made between four different types of measurement scales, namely *nominal, ordinal, interval* and *ratio* scales (Kinnear et al., 1993, Zikmund, 2003).

Nominal scales are regarded as the simplest scales solely, used to label specific characteristics of the addressed subject (Zikmund, 2003, Weis and Steinmetz, 2002), while ordinal scales already indicate a predefined order of the measured values (Kinnear et al., 1993). Similarly to ordinal scales, interval scales are also used to present an order of the measured objects, but moreover they allow measuring the distance between the variables in equal intervals whereby no zero point exists (Zikmund, 2003, Page and Meyer, 2000). Ratio scales are analogous to interval scales, however, including a definite zero point (Kinnear at al., 2003). In marketing research interval scales are merely used for assessing attitudes, opinions and predispositions (Kinnear et al., 1993).

In this study, nominal scales are used solely for categorising different manifestations of specific control variables, such as current position, functional area, or industry type. Other control variables, such as R&D intensity firm`s size, or firm`s age were measured using interval or ratio scales. For the majority of items in this questionnaire respondents were asked to report their responses on a seven-point likert scale, anchored with the statements ‘*I strongly agree*’ and ‘*I strongly disagree*’. Strictly regarded likert scales are ordinal in nature (Zikmund, 2003), however they are generally treated as interval or “ordinal interval” scale in research (Lukas et al., 2004, p. 334). This reasoning is justified as respondents are observed to treat the distance between the different options statements ‘*I strongly agree’* and ‘*I strongly disagree’* as equal. Therefore the use of likert scales as quasi-interval scales is widely accepted in research practice (Kinnear et al., 1993). All DC dimensions, their antecedent NO, most characteristics of the resource base, as well as the outcome variable RR were measured on a seven-point likert scale and threated as interval scale for the data analysis. Exclusively, knowledge breadth and depth and EO were measured on a semantic differential scale, where pairs of statements were given, which represent opposite ends and a seven-point scale divided the two ends. In line with the above argumentation this scale is also considered an interval scale in this research.

Beside the specification of the type of scale used, a definition of an appropriate number of measurement points was needed. The seven-point scale was regarded as appropriate in this research for the following reasoning: First, the scales used in this study were constructed with an odd number of measurement points to provide a focal point and thus allow the respondents to take a ‘neutral’ position in the middle of the scale (between the positive and negative labelled ends of the scale). This was deemed reasonable in avoidance of forcing undecided respondents to decide for one or another position. Moreover, seven points were evaluated as a sufficient level of differentiation for measurement, rather than five points, which emerged to be to imprecise, and nine points, which turned out to be too differentiated and overexerted the respondents as emerged from the discussion with experts.

Moreover, given the lack of archival data or external objective scales available for measuring the constructs of this study, this research was obliged to rely on self-reported assessments of the respondents. Thus for the majority of constructs perceptual, subjective scales were used. The study hence is limited to this point. This proceeding was justified as objective scales often are incident to lower levels of specificity in terms of industry, economic condition and time horizon and do not allow meaningful comparisons across companies (Song and Parry, 1997, Pavlou and El Sawy, 2011). Moreover to counterbalance the likely effect of overestimating of the firm`s own position when using perceptive scales, respondents were asked to assess their own firm`s position (in terms of capacities, resource endowments, RR success) relative to their major competitors respectively compared to the common practice in industry.

To sum up, measurement scales used in this study were described and their appropriateness for this research justified. A pre-test of the questionnaire however was deemed valuable to ensure accurate and consistent measurement and to test the operationalisation of the constructs and measurement scales in the context of this study. The pre-testing of the questionnaire is briefly described in the following section.

5.3.5 Pre-Test

The questionnaire was developed in accordance with general principles of good research in regard to content, wording, format and sequence to ensure accurate and consistent measurement (Kinnear et al., 1993, Veal and Ticehurst, 2005). To reduce measurement error and avoid ambiguity, special objective emphasis was given to a clear, easy to understand, and precise wording (Zikmund, 2003). A pre-test of the questionnaire was carried out during February 2013 among a group of experts, consistent of seven key informants from the university with focus on empirical research in innovation and marketing related fields and five key informants with industry background in the area of interest. The participants were asked to fill out the questionnaire and to give comments on potential biased, confusing or ambiguous questions or other perceived difficulties regarding the terms used in the questionnaire (Page and Meyer, 2000, Zikmund, 2003). Moreover feedback on the structure and sequence of the questions, as well as the appropriateness of survey instrument was asked for. Additionally, respondents were requested to document the time they needed to complete the questionnaire in order to assess and, if necessary, alter a feasible length of the questionnaire (Plewa, 2010). While no changes regarding the length were needed, minor changes were made regarding the wording, whereby special emphasis was given towards phrasing the terms in the professional language used by the respondents. For this purpose, informants were asked to re-phrase those questions they regarded as problematic to understand. The information gained was valuable to see, firstly if informants understood the content correctly and secondly to determine a more accurate wording (Plewa, 2010). The results of the pre-test supported that the data gained from the questionnaire would ensure an accurate and consistent measurement compliant with the research objectives. The final questionnaire is provided in Appendix 5.2.

Additionally to pre-testing the questionnaire in order to examine the statistical properties, it was deemed valuable to test the survey instrument in a small-scale study. Thereto the survey link was initially sent out to 10% of the sample to examine the statistical properties of the single measures (Pavlou and El Sawy, 2011). Given the good reliability and validity values achieved for all measures, the survey was approved to be send out to the whole sample.

To sum up, the questionnaire design was described in detail, compromising the levels of measurement, theory and statistical analysis, the operationalisation of constructs, measurement scales and pre-testing of the questionnaire. The following section outlines data collection and sampling issues.

5.4 Data Collection

This section describes the data collection process outlining the target population, the sampling procedure, sample size and structure. Empirical studies require the definition of the relevant population to be studied, as well as the determination of the target sample on which basis research findings may be generalised outside the collected set of research data (Zikmund, 2003). Vice versa it also sets the boundaries for the generalisation of the research finding (Page and Meyer, 2000). The following section provides a definition of the target population, further elaborates the sampling frame and procedure utilised to gain the final sample for this research, which is subsequently described in regard to its characteristics and tested for potential nonresponse bias.

5.4.1 Target Population

The target population is regarded as a collection of elements that share a specific set of characteristics, e.g. geographical and personal characteristics (Zikmund, 2003), which are considered as relevant to contribute the required information to achieve the research objectives (Lukas et al., 2004). The population for this research included UK business representatives engaged in innovation activities. The target population can be described more precisely through a specific set of characteristics: (1) personal characteristics as position, function and company size, (2) industrial characteristics namely industry sector and type, and (3) geographical characteristics as the target country.

Personal characteristics. Target respondents for this research were defined as individuals (i) holding an upper or middle management positions (e.g. CEO, Managing Director, General Manager, C-level Executive, Owner or Partner, Senior Manager, Middle Manager), (ii) working in an innovation-related functional area, defined for this research as including General Management, Innovation Management, Product Development Management, Business Development, R&D, and (iii) working in a small, medium or large companies, with a minimum of 10 employees. The reasoning behind this specific targeting is that these individuals are assumed to be typically involved in innovation and resource recombination activities in the company and therefore likely to have a good understanding of the firm`s resource endowments, processes and capabilities and their impact on firm`s innovation performance, which gives reasons to expect a high accuracy of the responses. Moreover, they are high enough in the hierarchy to possess an aerial view of the processes and routines to see a comprehensive picture, while at the same time still being sufficiently involved in the operational activities, enabling the evaluation of their own firm’s capacities and resources against competitors. Screening questions were included at the beginning of the questionnaire and only those respondents that possessed the defined characteristics were allowed to take part in the survey.

Industrial characteristics. This study is cross-sectional in nature, covering both manufacturing and service industries. However, only those industry sectors were included which are seen as innovation-active industries. As described earlier, R&D expenditure is generally accepted as an appropriate indicator for innovation in firms (OECD, 2011), and therefore was employed for identifying the relevant target industries for this research. While high R&D expenditure is often associated with high-tech firms aiming to develop new technologies, also established consumer goods companies are found to have high expenditures on a systematic basis to improve their existing products (Office for National Statistics, 2011). Hence R&D expenditure is regarded as a valuable indicator for measuring the industries` emphasis given to innovation, covering both innovation directed towards the development of new products and services, as well as the improvement of established products and services. To identify the most innovation-active industries in UK a statistic of the British Office for National Statistics (2011, p. 57) on R&D expenditures per industry sector performed in UK in 2011 was used. Out of 61 listed industries or groups of industries as defined by SIC codes, the TOP 15 industries in regard to R&D expenditures were identified and defined as relevant for this research, as those 15 industries account for more than 90% of the total R&D expenditures of 17.408 Mio £ in UK in 2011 (for a detailed description of sectors and numbers, see Appendix 5.3). Accordingly, the 2-diget SIC codes of those industries were matched against the internal coding scheme used by CINT[16] for the panel profiling, whereby only those firms were included in the target sample that could be assigned to one of the selected innovation-active industries.

Moreover, a further screen-out question was included in the questionnaire, where all 21 industry sections as defined by the SIC Code were listed and only those six defined as relevant for this research, namely (C) Manufacturing (SIC 10-33), (G) Wholesale and trade (SIC 45-47), (J) Information and Communication (SIC 58-63), (K) Financial and Insurance activities (SIC 64-66), (M) Professional scientific and technical activities (SIC 69-75) as well as (N) Administrative and support service activities (SIC 77-82), were allowed to take part in the survey. Consequently, the main focus of this research lied on the six industries which again were deliberately selected to capture those 15 sub-industries responsible for more than 90% of the overall R&D expenditure in UK. Additionally, as a control variable used to test if the right target sample was reached, respondents were asked to indicate the percentage of sales spend on R&D expenditures. With the integration of several industry types, this research did not concentrate on a specific industry segment (e.g. high-tech manufacturing), but rather concentrated on both manufacturing and service industries in order not to limit the potential sampling frame and at the same time to keep the cross-sectional nature and relevance of the concept of study.

[16] CINT is a professional panel data provider that was conducted for target sampling as described in 5.4.2.

Geographical characteristics. The geographical focus of this study was restricted to United Kingdom (UK), meaning that only respondents working in companies resident in UK were targeted. This was deemed valuable to prevent the results from being biased by national culture issues (Plewa, 2010). The CINT UK panel list (as described below) was used providing a representative sample of the UK population, regarded as the basic population used in this research. Given this definition of the general population, the sampling frame was further specified in a step-wise sampling procedure applied to ensure the access to the target population as defined above.

5.4.2 Sampling Procedure and Sample Size

Different procedures can be used by researchers to select samples for their research (Kinnear et al., 1993). As no contact lists of the target population as described as relevant for this research exists, the help of CINT a professional panel data provider was conducted. CINT provides access to contacts of industrial representatives through their representative UK online panel, with a total of 564.867 listed panelists in UK. During the whole process it was ensured that the participation within the panel was genuinely voluntary. The following section outlines the four steps of the sampling procedure used in this research to attain the final sample.

Framing the sample. The invitation email to take part in the survey was distributed to a total number of 30.712 people (*invited sample*) drawn from the representative UK online panel with 564.867 listed panelists (*general population*) based on age, gender, company age, industry sector, and position. In the period from 15th March 2013 till 3rd April 2013, 21 daily batches were released in total. Additionally, two days apart from the initial invite, reminders were send. The respondents were asked to click on a link in the email message, which directed them to the CINT landing page. Of these potential candidates for the survey, a total number of 7.581 respondents clicked on the link to take part in the study and entered the CINT landing page, resulting in a response rate of 24.5%. CINT uses a reward system for their panelists, for a 20 minutes survey the respondents are incentivised by marketplace points equivalent to a value between £1.20 to £1.52. The incentive have been set to encourage long-term participation, but also to discourage professional respondents who seek to take surveys only to obtain payment. Furthermore, as the target respondents are industrial representatives in middle and upper management positions in the UK, which can be considered as well-paid, cash payment can be seen rather as a representation allowance for the participants. Therefore, the incentive might affect their intention to take part in the study, but it would not cause any industrial representative to consent to risks that they might not otherwise find acceptable. In addition, the respondents were offered a customised report summarising the results of the study to increase the response rate.

Panel Profiling. To ensure the right target sampling and guarantee quality standards, in a first pre-screening step executed by CINT, 6.996 respondents were screened out from the sample due to either not fitting predefined selection criteria defining the target group (company age, respondent`s position, industry sector, company size) or not fulfilling security criteria (e.g. the respondent did not have a unique IP address, the survey was already taken by the respondent, the survey was already closed), leading to an effective target sample of 617 people (*target sample 1*) that qualified and hence were allowed to take part in the survey. This profiling step aimed at developing a database of key informant engaged in leading positions in industries where innovation takes place. Individuals acting in those positions and industry sectors were likely to fit the requirements of this study. Of the 617 people in the target sample, 585 target respondents actually entered the survey in UNIPARK, were the first page was used to explain the purpose of the research and strict confidentiality of the results was ensured (for a screenshot of the invitation page, see Appendix 5.2).

Target Sampling. In a second pre-screening step, which was executed by the researcher to cross-validate the validity of sampling and further sharpen the target group, additional screening questions were included on the second page of the survey. As a result of this step from the 585 respondents that entered the survey another 243 respondents did not qualify for the target group, and thus were not allowed to continue the survey and were redirected, as key informants either did not work in one of the selected functional areas (152) or target industry sectors (86) for this research, worked in a company below 10 employees (2), or did not possess one of the target positions (3) defined as relevant for this research. This step was conducted in addition to the first pre-screening step, as the panel profiling by CINT allowed only the selection of pre-defined categories and might not always be up to date as people change their company and position. Moreover, the pre-screening aimed to reduce the potential risk of addressing people that might not be knowledgeable regarding RR. Finally, 342 respondents qualified for taking part in the survey (*target sample 2*), as they fulfilled all criteria of the target group, and filled out the questionnaire.

Validating. After eliminating those responses which did not complete the questionnaire and entailed systematically missing values (20), a total of 322 fully completed questionnaires were returned. From those 322 completed questionnaires another 114 respondents were identified as 'unengaged respondents' and therefore were further eliminated from the data set. The identification of those cases based on quality control variables that were included in the questionnaire, and gave indications that either the time to complete the questionnaire was regarded as to low to ensure the high quality of answers (71), or that the responses entailed systematic error and invalid answers (43). This final validation step resulted in a final sample of 208 quality proven completes, that were used for the data analysis to test the conceptual model (n=208).

Table 5.1 gives an overview of how the final sample was drawn, entailing the single steps that led to the final sample used for the quantitative analysis.

Table 5.1 Sampling Procedure and Sample Size

Total number of panelist in UK: *= General Population*	**575.126**
Total number of people invited to the panel: *= those that received the invitation email = candidates = Invited Sample*	**30.712**
Total number of respondents: *= those that clicked on the link and entered the CINT landing page*	**7.581**
Total number of screen outs after stage 1 – CINT, amongst those: *- due to security termination[14]* *- due to full quotas* *- used as test cases* *- due to the survey was already closed* *- based on the CINT Pre-Screener 1: Company Age* *- based on the CINT Pre-Screener 2: Position* *- based on the CINT Pre-Screener 3: Industry Sector* *- based on the CINT Pre-Screener 4: Company Size*	**- 6.996** 1.026 59 2 291 103 4.067 1.271 145
Target sample 1 (qualified respondents after first screen out – CINT): *= those that qualified for entering the online survey*	**= 617**
Target respondents 1 *= those that entered the online survey*	**585**
Total number of screen outs after stage 2 – RESEARCHER, amongst those: *- based on the INTERNAL Pre-Screener 1: Function (added)* *- based on the INTERNAL Pre-Screener 2: Position (double check)* *- based on the INTERNAL Pre-Screener 3: Industry Sector (double check)* *- based on the INTERNAL Pre-Screener 4: Company Size (double check)*	**- 243** 152 3 86 2
Target sample 2 (qualified respondents after second screen out – RESEACHER): *= those that entered and qualified for the survey*	**= 342**
Total number drop outs: *= those that dropped out during the survey*	**- 20**
Full Completes: *= those that fully completed the survey*	**= 322**
Total number of screen outs for quality reasons, amongst those: *- based on Quality Control Variable 1: Duration <300 sec* *- based on Quality Control Variable 2-4: invalid answers*	**- 114** 71 43
Quality checked Completes: *= those that qualified for data analysis*	**= 208**
Completion rate: *= Full Completes / Target sample 1*	**55%**
Drop-out rate: *= Total number of drop-outs/ Target sample 2*	**6 %**
Response rate: *= Number of respondents / Number of people invited*	**24,6 %**

5.4.3 Sample Structure

As a result of the sampling procedure, 208 key informants from different companies contributed to the survey, providing the data set on which the conceptual model was empirically tested. In the following, a detailed description of the specific characteristics and attributes of the final respondents is given. An overview of the characteristics of the final respondents is provided in Table 5.2.

In accordance with the target sample, responses were collected from six different **industry types**, including manufacturing (20%), professional, scientific and technical activities (22%), wholesale and retail trade (21%), financial and insurance activities (16%), information and communication (15%), and administrative and support activities (7%). Interestingly, when looking at those firms working in manufacturing industries, they could be further specified as manufacturer of computer, electronic and optical products (17%), machinery and equipment (10%), pharmaceutical products (7%), rubber and plastic products (7%) and furniture (7%), metal products (5%), motor vehicles, trailers, transport-tation equipment (5%), paper products (5%), and food products (5%), or other manufacturing products (29%) as indicated by the respondents classification according to the SIC Codes. Given that all of the TOP 15 most innovative industry types measured by R&D expenditure as reported by the British Office for National Statistics (refer to Appendix 5.3) are well represented in the sample, the strong focus of this research onto innovation-active industries is reflected by the sample structure.

This is also supported by the figures about **R&D intensity** as reported by the respondents, were the vast majority of companies in the sample (59%) exhibited R&D expenditures of more than 3% of sales, and therewith laid considerably above the OECD average of 2.3% in 2011 (OECD, 2011). Moreover, 39 of the companies (equals 22%) spend more than 10% of sales on R%D, and therefore can be classified as high-tech manufacturing firms, thus regarded as highly innovation-active companies according to the OECD (2011) segmentation. Notably, 31 respondents did not know the percentage of sales spend on R&D and therefore were not included in the statistics.

From the final responses 79% were in middle and 21% in upper management **positions**. Of the final respondents 108 respondents were working as middle manager and 61 respondents as senior manager, while another 20 respondents were employed as C-level executive (CFO, CIO, COO) and 14 respondents as CEO, managing director or general manager of the company. Only 9 respondents acted as owner or partner of the company. The **functional areas** of the interviewees ranged from General Management (63%) to more specialised functions as Business Development Management (13%), Research and Development (10%), Product Development Management (10%) and Innovation Management (4%). In regard to **company size**, 50% of the respondents worked in big companies (with more than 250 employees), 29% were engaged in medium-sized companies (with a number of employees between 51 and 250), and only 21% worked in smaller companies (with 10 to 50 employees). In terms of the companies` **ownership structure**, nearly two-thirds of the respondents were working for private companies that were either family-owned (9%) or owned by the CEO and family (57%). On the other hand 26% worked for public companies listed on the stock exchange, while 8% indicated to work in a company with another ownership structure. The **age of the companies** differed considerably, from 1 year to 331 years, with the median age of 27.5 years. Only 8 companies were 5 years and younger and thus regarded as new companies.

The following Table 5.2 gives an overview of the characteristics of the final respondents, which were further considered for the data analysis and discussion.

Table 5.2 Characteristics of Final Respondents

Current Position	CEO	C-level Executive	Owner/ Partner	Senior Manager	Middle Manager	Total
N	14	20	9	61	104	208
%	7%	10%	4%	29%	50%	100%
Functional Area	General Mgmnt	Innovation Mgmnt	Product Developm. Mgmnt	Business Developm. Mngmt	R&D	Total
N	131	9	20	27	21	208
%	63%	4%	10%	13%	10%	100%
Respond. Age	14-22		23-35	36-55	56-80	Total
N	0		56	115	37	208
%	0%		27%	55%	18%	100%
Gender		Males		Females		Total
N		129		79		208
%		62%		38%		100%
Company Size	10-50 employees		51-250 employees	> 250 employees		Total
N	44		59	105		208
%	21%		29%	50%		100%
Company Age	Minimum = 1 year	Lower Quartile = 17 years	Median = 27.5 years	Upper Quartile = 57 years		Maximum = 331 years
Ownership Structure	Public Company (listed on stock exchange)		Private Company (CEO and family)	Family-Owned Company	Other	Total
N	54		119	19	16	208
%	26%		57%	9%	8%	74%
R&D Intensity	< 1%	1-3%	3,01-10%	>10%	Missing data	Total
N	29	43	66	39	31	177
%	16%	24%	37%	22%	--	100%
Industry Type	Manufac-turing	Wholesale and retail trade	Information and Communication	Financial and insurance activities	Professional, scientific and technical Activities	Administrative and support service activities
N	41	43	31	34	46	13
%	20%	21%	15%	16%	22%	6%

Industry Type: Manufacturing	**N**	**%**
... of computer, electronic and optical products	7	17
... of machinery and equipment n.e.c.	4	10
... of basic pharmaceutical products and pharmaceutical	3	7
... of rubber and plastic products	3	7
... of furniture	3	7
... of fabricated metals or metal products	2	5
... of motor vehicles, trailers, transportation equipment	2	5
... of paper and paper products	2	5
... of food products	2	5
... of other manufacturing	12	29
Missing	1	2
Total	**41**	**100 %**

The outline of the final sample showed that the target group as defined in section 5.4.1 was reached. Following the discussion and outline of the final sample structure the following section elaborates on the potential nonresponse bias in the data.

5.4.4 Nonresponse Bias

Nonresponse bias addresses a potential problem while using survey instrument, concerned with the number of people not responding to the questionnaire, and the risk that the answers of these nonrespondents would have differed considerably from the respondents (Pearl and Fairley, 1995). Firstly, efforts were taken to maximise the response rate leading principally to a reduction of nonresponse bias (Armstrong and Overton, 1977). The attained response rate of 24,6 % was regarded as reasonable and compared well with similar studies among the target group, considering the time-consuming nature of middle- and upper management jobs, moreover a group of people that tend to be over-surveyed by researchers, and paired with potential concerns about confidentiality.

Secondly, following the approach by Armstrong and Overton (1977), early and late respondents in the sample were compared across selected key variables to estimate nonresponse bias. The procedure was used to verify that early and late respondents did not differ in their responses. Those respondents that answered in the first (two) week were considered as earlier respondents (163), while all others regarded as late respondents (45). Levene's test for the equality of variances was conducted to test for potential differences in variances (Brosius, 2004), followed by a t-test for assessing the equality of means (Coakes and Steed, 2003) between the two groups. The results showed no significant differences between the two groups for any of the variables, neither in terms of demographics nor in terms of parameter values ($p < 0.05$ level). The results are presented in Appendix 5.4, showing the 2-tailed significance level for demographics, including current position, company size, company age, industry sector, as well as for the selected key variables, including *Sensing, Learning, Integrating, Coordinating capacity, Technological and Market Knowledge* and *RR, Entrepreneurial Orientation* and *Networking Orientation*. Given that no significant differences in variance and in means between early and late respondents emerged, it could be assumed that nonresponse bias is not a serious problem and that the sample was adequate for further analysis.

Besides nonresponse bias, common method bias was tested, which is a potential bias in the data caused by a systematic external measurement error and hence attributed to the measurement method used. The approach by Podsakoff et al. (2003) was used to calculate the likelihood of common method variance being present in the data, the procedure and results are detailed in chapter 6.4.4.

5.5 Chapter Summary

This chapter described the methodology chosen for the quantitative research study. First, the reasons for choosing a self-administered online survey as appropriate data collection method for the quantitative analysis of the model and hypotheses were detailed and discussed.

Subsequently, the questionnaire design was outlined, describing the levels of measurement, theory and statistical analysis, and the operationalisation of constructs. In the core of this section a detailed description of the measurement items and scales used to capture each constructs was provided, resulting in the final questionnaire, which qualified after being pre-tested as appropriate measurement instrument and was used for the quantitative study.

The last section of the chapter elaborated on sampling issues. Starting with a detailed description of the target population and its specific characteristics, the step-wise sampling procedure used to reach the target respondents was outlined. With the help of a professional panel data provider, the invitation email to take part in the survey was distributed to a total number of 30.712 people, of which a total of 7.581 people responded, resulting in a response rate of 24.5%. A first panel profiling step lead to an effective target sample of 617 respondents, 585 entered the survey, and after a second screen out stage a total of 322 fully completed questionnaires were returned. After a final validation step, 208 responses qualified for being included in the further data analysis to test the conceptual model (n=208). Screening questions were used for the panel profiling and at the beginning of the questionnaire to ensure that the right target respondents were reached.

The chapter closed with a detailed description of the final sample, which showed to represent a good cross-selection of the target group as defined before, and thus allows a generalisation of the research findings outside the collected set of data.

Chapter 6: Results

6.1 Introduction

This chapter outlines the individual steps of data analysis and presents the results of the quantitative research step. The data was analysed applying structural equation modelling (SEM) principles using the statistical software *SPSS AMOS 20*. SEM serves purposes akin to a regression-analytical approach (Schreiber et al., 2006), however is regarded as “a more powerful alternative to multiple regression, path analysis, factor analysis, time series analysis and analysis of covariance” (Gaskin, 2012a, Gason, 2012) and is utilised in this research for several reasons. First, the central advantage of SEM lies in its potential to evaluate entire models proposed on the basis of previous research steps (Steenkamp and Baumgartner, 2000). Second, by accounting for measurement and structural error, and modelling of interactions, nonlinearities or correlations across the models’ independent variables, SEM is regarded to offer a more accurate analysis than other multivariate methods (Diamantopoulos and Siguaw, 2000, Gaskin, 2012a). Third, an additional advantage SEM has over other multivariate methods is its ability to integrate latent or unobservable constructs measured by multiple indicators which are often to be found in marketing literature (Parasuraman et al., 1988, Gaskin, 2012d) and are also existent in this research study. For this reasoning and by conducting a confirmatory rather than exploratory approach to data analysis (Byrne, 2001), in recent years SEM is achieving a high popularity among researchers from different disciplines (Kline, 2005, Garson, 2012). Consequently, SEM was identified as a valuable and appropriate method of data analysis for this research. This chapter elaborates the quantitative research steps undertaken in depth and detail.

After a brief introduction and overview presented in this section, the data preparation steps and evaluation of normality of the data are described. A description of the **Exploratory Factor Analysis (EFA)** follows, whereby the factoring method and rotation type leading to the resulting factor structure are presented first, moreover an outline of analyses relating to construct reliability and validity is given.

The fourth section outlines the results of the **Confirmatory Factor Analysis (CFA).** In this section the criteria for the evaluation of the model fit, the so called goodness-of-fit indices, are presented first. Subsequently, the one-factor congeneric **measurement models**, used for the calculation of the composite scores for the latent constructs, along with their factor score weights and respective model fit indices are presented. In addition to this, and analogous to the procedure applied during the EFA, an assessment of the constructs validity and reliability is conducted and the results are reported. Additionally common method bias (CMB) and measurement model invariance is tested. Finally to this section the procedures used for the calculation of the composite scores for the reflective measurement models as well as the formative construct used to measure RR, are described and their use is justified.

The fifth section of this chapter finally outlines the **structural path model** for analysing the causal relationship between the constructs, including hypotheses testing. Prior to any analyses important concerns for a stable application of the SEM procedure are described, comprising the model identify-cation as well as a variety of multivariate assumptions, namely linearity, (absence of) multi-collinearity and heteroscedasticity. Having ensured a stable application, the structural path model is analysed. First, the conceptual model and proposed interrelationships among the endogenous and exogenous constructs (as conceptualised in chapter 3 and 4, respectively) is tested by means of structural path analysis using AMOS. Second, the conceptual structural path model is re-specified with the aim to achieve a more parsimonious, well-fitting model. Given the achieved good overall model fit, the re-specified structural path model qualifies for the subsequent hypotheses testing.

The subsequent sections present a more detailed investigation of the theorised **mediation effect** (section 6.6) by means of mediation analysis, and **moderation effects** (section 6.7) by means of multi-group moderation and interaction effect analyses. This is followed by a discussion of the **competing models** (section 6.8).

The last section of this chapter summarises the results of the quantitative research and hypotheses support. While the results are presented and analysed in this chapter, a detailed discussion of the research findings is provided in chapter 7. Based on the research cycle presented by Gaskin and Lyytinen (2011), Figure 6.1 gives an overview of the individual analysis steps conducted for this research while embedding it in the overall research process.

Figure 6.1 Research Cycle

Source: adapted from Gaskin and Lyytinen (2011)

6.2 Data Preparation and Normality

6.2.1 Data Preparation

To ensure that the observed data is clean, thus useful for testing causal relationships the data needs to be prepared before conducting any statistical analysis (Gaskin, 2012a). Hence for this research the data was prepared in a four step procedure, including (1) **re-codification** of reverse-codes variables, (2) screen out of **unengaged responses**, (3) **clearing of missing data** and (4) **detection of outliers.**

First, in a **re-codification** step all reverse-coded variables (V1604_KnowSpeci, V2201_InnoPerf, V2306_EntreOrient, 2307_EntreOrient, V23078EntreOrient) were re-coded.

Second, **unengaged responses,** referring to respondents that answered with systematic error (e.g. a single value for each question, a constant row of numbers etc.), were screened out as described previously, both by calculating the standard deviation (SD) per row, whereby a SD < 0.5 implies an insufficient amount of variance in the responses, and by means of visual screening (Gaskin, 2012a). The latter was supported by inserting four quality control variables: *Q1_duration, Q2_knowledge specificy*[17], *Q3_innovation performance*[18], *Q4_entrepreneurial orientation*[19]. Variable Q1 captured the time each respondent took for answering the questionnaire. Those cases, where respondents took below five minutes, were screened out. The other three variables were used to test the consistency of answers given by the respondents for the respective constructs. Cases that did not show a logical consistency were additionally screened out.

Third, **missing data** in the sample was analysed utilising SPSS 20. All respondents with more than 5% of missing data were screened out from the sample to preserve the data from being biased. In the remaining two cases, missing values were replaced with the maximum likelihood (ML) estimation. The ML estimation was chosen as appropriate method as it has shown to be the least biased method for the replacement of missing data (Hair et al., 2010) and was approved as valuable method by previous research (Byrne, 2001, Plewa, 2010). From 322 completed questionnaires, based on the quality control variables described above, 43 respondents were identified as unengaged respondents based on

[17] **Q2_knowledge specificy:** V1604 was used as control variable, after being re-codified it should show similar values as V1601/V1602/V1603. Comparing the values of V1604 with V1601/V1602/V1603, the responses were classified into three groups: 0 = V1604 and V1601/V1602/V1603 show opponent values, 1 = V1604 and V1601/V1602/V1603 show equal (or only slightly different) values, 2 = V1604 and V1601/V1602/V1603 differ for more than 3 points)

[18] **Q3_innovation performance:** V2201 was used as control variable, after being re-codified it should show similar values as the remaining items used to measure innovation performance and V2301. The responses were classified into three groups following the same procedure as described above.

[19] **Q4_entrepreneurial orientation**: V2306, V2307 and V2308, were used as control variable, after being re-codified they should show similar values as the remaining items used to measure EO. The responses were classified into three groups following the same procedure as described above.

poor quality (in regard to Q2,Q3,Q4) and another 71 respondents were disclosed based on duration (in regard to Q1). In sum, 208 quality proven respondents qualified for the further analyses (n=208).

Fourth, data was tested for **outliers** (Kline, 2005), as they can bias the results, pulling away the mean from the median (Gaskin, 2012a). Two types of outliers are differentiated: *univariate outliers* for the individual variables and *bivariate outliers* for the model (Gaskin, 2012a). As in this research all latent variables were measured on a likert scale, only continuous variables as company age were eligible for detecting univariate outliers. By means of calculating boxplots in SPSS, those variables being identified as outliers were replaced by the mean. Testing for bivariate outliers Mahalanobis d-squared was calculated in AMOS (Gaskin, 2012a), the results did not show influential multivariate outliers.

6.2.2 Check for Normality

A necessary precondition for the stable application of SEM procedures is the assumption of multivariate normality in the data (Hair et al., 2010). Following Gaskin (2012a) normality refers to the distribution of the data for a particular parameter. To ensure univariate and multivariate normality, skewness and kurtosis were analysed (DeCarlo, 1997).

Skewness refers to whether the responses are distributed towards one end of the scale, implying that data is not normally distributed. Values for skewness ranged between 0.057 and -0.925 (see Table 6.1). As only values above 1 are referred to as being positive (right) skewed and values below -1 are regarded as being negative (left) skewed (Gaskin, 2012a), all variables met the required criteria.

Kurtosis on the other hand refers to the peakedness respectively flatness of data distribution (Gaskin, 2012a). With values for kurtosis lying between -0.656 and 1.075 only the value for Market Knowledge slightly exceeded the recommended threshold of +/-1 indicating to slight non-normality, while all other values indicated that univariate normality was established (Lei and Lomax, 2005) (see Table 6.1 below). Also the c.r.-values for kurtosis showed acceptable results, again only the value for Market Knowledge lied above the critical threshold of 2.57 (Backhaus et al., 2010).

Table 6.1 Assessment of Normality

Variable	min	max	skew	c.r.	kurtosis	c.r.
NetwOrientFact	1	7	-0.740	-4.359	0.345	1.015
EntreOrientFact	1	7	-0.133	-0.781	-0.656	-1.931
SensingFact	1	7	-0.871	-5.131	0.853	2.51
IntegratingFact	1	7	-0.713	-4.198	-0.038	-0.111
LearningFact	1.97	7	-0.416	-2.448	-0.402	-1.183
MarketKnowlFact	1.55	7	-0.925	-5.444	1.075	3.164
TechnoKnowlFact	2	7	-0.648	-3.813	-0.311	-0.916
CoordinatingFact	1	7	-0.739	-4.352	0.705	2.075
RR_singleitem_Composit	2.5	7	0.057	0.338	-0.146	-0.43
Multivariate					**19.493**	**9.99**

Looking at *multivariate normality* according to Kline (2005) only values for skewness higher than 3 and values for kurtosis higher than 10, may be regarded as problematic. With a multivariate value for kurtosis of 19.493, multivariate non-normality may be suggested, however considering the common lack of multivariate normality in research practice (Byrne, 2001, Gaskin, 2011), this is regarded as acceptable.

However, to restrict the impact of multivariate non-normality on the data analysis results, a range of procedures was established. First, as the principal goodness-of-fit index (the Chi-Square χ^2) is rather sensitive to non-normality, a range of alternative fit indices was employed for analysing model fit, e.g. the Normed Fit Index (NFI) and Comparative Fit Index (CFI) as detailed in chapter 6.4.1 (Lei and Lomax, 2005). Second, the **Bollen-Stine bootstrapping technique** was applied to reduce the reliance on normality assumptions regarding the distribution of the parameters (Hair et al., 2010). The Bollen-Stine bootstrapping (Bollen and Long, 1991) is a statistical re-sampling technique by which multiple sub-samples are created out of the original sample from which the confidence estimates are derived (Byrne, 2001). While using this method, a sample is seen as a "pseudo-population that represents the broader population from which the sample was derived" (Preacher et al., 2007, p. 190). By computing the statistics that are of interest in multiple re-samples of the data set, the sampling distribution of any statistic can be reproduced (Preacher et al., 2007). Hence, bootstrapping was applied for the data analyses, as it allows testing the theorised model and its hypotheses by offering an alternative, "modified bootstrap method for the Chi-Square goodness of- fit statistic" (Byrne, 2001, p. 284). Subsequent to the outline of data preparation and normality, the following section details the Exploratory Factor Analysis, as a first SEM step. Further multivariate assumptions as linearity, multicollinearity and homoscedasticity will be discussed in chapter 6.5.2.

6.3 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) is a multivariate statistical method used to identify the underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome (Child, 1990). The EFA is exploratory in nature, and therefore often builds the first step in a SEM procedure. Based on these results, a Confirmatory Factor Analysis (CFA) is applied in a subsequent research step (refer to section 6.4). The CFA aims to confirm the predicted relationships and to set up the final measurement model for the latent constructs to be included in the structural path model.

On the basis of correlations among the observed variables (measurement items) in the data set, the EFA identifies a smaller number of underlying factors (latent constructs) that comprise all substantial information about the linear interrelations between the variables in the data set (Backhaus et al., 2008). Accordingly, the aim of the EFA procedure is the reduction of the data structure with the help of a minimal number of factors (Backhaus et al., 2008). As a result, an EFA aims to achieve distinct constructs (discriminant validity), that each measures a single thing (convergent validity), and that are reliable (reliability) (Gaskin, 2012b). In total 61 observed variables from the questionnaire were included in the EFA. Being conceptualised as a formative construct, however, the indicators for RR could not be included in the EFA (and CFA as well) as this would have been an obstacle to the EFA`s (and CFA`s) underlying assumption of reflective constructs (Backhaus et al., 2008) (the formative constructs are considered separately in chapter 6.4.6). The measurement items applied in the questionnaire already indicate the expected factor structure. However, despite of usage of established scales, some items might not capture what they were thought to measure. Therefore, it was deemed valuable to first test in an exploratory research step using EFA, which items belong to which constructs as it helps identifying what the factor structure looks like according to the participants' responses. Vice versa, an EFA is also useful to discover variables that are in spite of theoretical considerations not fitting well to the constructs. Therefore, EFA is considered as a valuable instrument to prepare the variables in order to provide a cleaner factor structure to be used in a CFA as a subsequent SEM step (Gaskin, 2012b). Factor analysis thus is regarded a fundamental component of SEM (Gaskin and Lyytinen, 2011).

6.3.1 Factoring Method and Rotation Type

Beside the specification of variables included in the EFA the selection of (a) the method for factor extraction, (b) an adequate rotation method, as well as (c) the criteria for the extraction of factors were important considerations, outlined in the following section.

In general there are two main **methods for factor extraction**: Principal Component Analysis (PCA) and Principal Axis Factoring (PAF)[20]. The main difference between the two methods lies in the way the communalities are used. Generally researchers pointed out that the decision whether to make use of the PCA or the PAF procedure should solely be made on the basis of content based considerations (Backhaus et al., 2008). For this research the use of the PCA was justified, as it is the most commonly used technique for identifying important dimensions in multivariate datasets (Cooley and Lohnes, 1971, Hildebrandt and Temme, 2006) and widely accepted by different scientific disciplines (Abdi and Williams, 2010). While some restrictions exist for a PCA, as the algorithms do not consider the errors in the measurement of the variance as well as the specific variance of the indicators (Hildebrandt and Temme, 2006), many authors agree on the benefits of the PCA in

[20] Other extraction methods exist in literature, however PCA and PAF are the most commonly used (Field, 2000).

comparison to other factor extraction methods, especially in the SEM context (e.g. Fabrigar et al., 1999). Thus, generally leading to a clearer factor structure the PCA method is preferred over the PAF, where the resulting factor structure often suffers from score indeterminacy (Arrindell and van der Ende, 1985). Furthermore the "solutions generated from principal component analyses differ little from those derived from factor analyses techniques" (Field, 2000, p. 434), hence the algebraic differences between the two methods are found to be minimal (Velicer and Jackson, 1990) and even decreases as the number of variables and the magnitudes of the factor loadings increases.

Another decision that had to be made is the choice of an adequate **rotation method**. Due to the fact that direct (unrotated) extraction methods gain the factor matrix directly from the correlation matrix, most often the resulting factor solutions are not sufficient for interpretation. By reducing some of the ambiguities associated with the direct extraction method, rotation methods cause factor loadings to be more clearly differentiated and thereby facilitate interpretation of the factor loadings (Child, 1990, Gaskin, 2012b). Simply said, the aim of rotation is to simplify the data structure. Generally two rotation types can be differentiated: *orthogonal* and *oblique* rotation types (Costello and Osborne, 2005). While the Varimax rotation, as an orthogonal rotation method, is the most commonly used, it contains the underlying assumption of uncorrelated factors and often result in an inexplicit factor structure, where it is not easy to assign indicators to factors. Due to the fact that factors in empirical studies often exhibit small and moderate correlations, which violates the assumption of the Varimax rotation, Hildebrandt and Temme (2006) regard this method as inappropriate in an SEM context and suggest instead making use of an oblique rotation type, such as Promax. Oblique rotation types consider a moderate correlation between the factors being analysed (Costello and Osborne, 2005). As detailed in chapter 3.4.1.6, the constructs used in this research are expected to be weakly correlated with each other. Thus, given that "there is substantial theoretical and empirical basis for expecting the constructs to be correlated with each other (…) oblique rotations provide a more accurate and realistic representation of how constructs are likely to be related to one another" (Fabrigar et al., 1999, p.282). In addition, oblique solutions provide more information than orthogonal rotations, because orthogonal rotations require factors to be oriented in 90° angles in the multidimensional space whereas oblique rotations allow orientations of less than 90°. As a result, orthogonal rotations usually lead to solutions that have a more simple structure when the interrelation of the factors is based on correlated factors (Fabrigar et al., 1999). For this reasoning, Promax rotation was selected as appropriate for this survey.

With the aim of keeping factors in the analysis that account for most of the variance in the data set, determining the right number of factors in the final solution is a critical step. Therefore different statistical **criteria for the extraction** of factors exist. Beside the Kaiser criterion that considers those factors with an eigenvalue greater than 1 as common factors (Nunnally, 1978), Cattell`s scree test, also named “elbow criterion”, is another commonly used method. However, to solely base the decision on statistical criteria seldom leads to the correct number of factors (Hildebrandt and Temme, 2006). Hence the extraction of factors should also be based on content and interpretability criteria (DeCoster, 1998). Consequently, a 12 factor solution (eigenvalue = 0,875) was chosen in favor of a 10 factor solution suggested by the Kaiser criterion (eigenvalue > 1) and Cattell`s scree test. As for the 12 factor solution all extracted factors measure different constructs and contain at least three item per factor with sufficiently high loadings on the respective factor (>0.40), that beside share a conceptual meaning, and no cross-loadings (Gaskin, 2012b).

6.3.2 Factor Structure

Before presenting the resulting factor structure of the EFA, relevant quality measures are controlled for, namely the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, the Bartlett's test of sphericity, the off-diagonal elements of the anti-image covariance matrix, and the commonalities of the factor solution.

First, the **Kaiser-Meyer-Olkin measure** of sampling adequacy, which determines whether a dataset is appropriate for an EFA, was tested (Kaiser et al., 1974). While a minimum for the KMO value is reported at 0.50, values over 0.80 are considered as very good (Frohlich and Westbrook, 2001). With a KMO value of 0.898 an excellent selection of variables for factor analysis was confirmed. Second, the **Bartlett test of sphericity** showed a significant and positive result ($p<0.001$), which indicates that the matrix is not an identity matrix, meaning that the variables are appropriate for EFA (Frohlich and Westbrook, 2001). Third, the inspection of the off-diagonal elements of the **anti-image covariance matrix** gave further evidence that the sample is adequate for an EFA, because all variables are above a critical value of 0.5 (Field, 2000). Fourth, the **communalities** of the factor analysis, indicating the degree to which one item correlates with all other items, were checked. Higher communalities are appreciated as low communalities (< 0.4) indicate that a variable will not significantly load on any factor (Gaskin, 2012b). In this model the smallest communality is at 0.69, which proves all variables as being useful for further analyses. The results are provided in Appendix 6.1.

As all quality criteria displayed adequate values, the **resulting factor structure** of the EFA, which shows the loadings for each variable on each factor, is presented in Appendix 6.2. The factor structure refers to the intercorrelations among the variables being tested in the EFA (Gaskin, 2012b). Using an iterative process of withdrawing those items showing low loading on the respective factor or loadings across different factors, the aim was to achieve a suitable factor structure used for further analyses. The result of the EFA was a rotated pattern matrix consistent of 12 factors that account for 79.46 % of the variance in the data. As the results indicate, an ideal factor structure could be derived in which convergent and discriminant validity are evident as all variables show high factor loadings on each respective factor and no cross-loadings exist (Gaskin, 2012b). While single items had to be withdrawn within the process of clarification, the results show that all remaining variables ideally loaded on the respective factors, which confirms the theoretical considerations. Notably, as already indicated by the qualitative research findings (refer to chapter 4.4.3), respondents had difficulties in differentiating between knowledge *breadth* and *depth*, the respective items were also statistically loading on a single factor in the quantitative analysis, used to measure the quality and diversity of Market Knowledge and Technological Knowledge, respectively.

6.3.3 Construct Reliability and Validity (from EFA)

Even though the clean factor structure presented points towards an adequate solution, a more detailed assessment of validity and reliability of the factors is required. This is to ensure that the measuring variables are consistent and accurate, and capture what they are intended to measure (Hair et al., 2010).

Content validity comprises the subjective expert opinion on the appropriateness, meaningfulness and usefulness of a measurement and evaluates if it represent all facets of the given construct (Kinnear et al., 1993, Zikmund, 2003). Content validity was already considered during the questionnaire design phase (by founding the scales used on previous research findings), tested during the pre-test of the questionnaire and lastly approved through the exploratory research step, as the resulting factor structure reproduces what theory suggested (e.g. each variable loads on the respective factor, and those that are similar in nature load on the same factor).

Convergent validity is given when the variables within a single factor are highly correlated (Kinnear et al., 1993, Zikmund, 2003), as indicated by sufficiently high factor loadings. Sufficient loadings are determined by the sample size, as regularly smaller samples require higher loadings. For a sample size of 200 loadings above 0.40 are recommended (Gaskin, 2012b). As can be seen from the pattern matrix (Appendix 6.2), all items achieve sufficient loadings on each factor (>0.40).

Discriminant validity on the other hand refers to the extent, to which the single factors are distinct and uncorrelated among each other and thus can be regarded as complement of convergent validity (Page and Meyer, 2000). When discriminant validity is given, this means that the factors are theoretically different, as the rule is that the variables should relate more strongly to their own, respective factor than to any other factor (Gaskin, 2012b). As presented in the pattern matrix, discriminant validity is ensured as all variables load solely on one factor and no significant cross-loadings[21] exist. Additionally, correlations between factors should not exceed 0.70, as correlations

[21] Cross loadings refer to variables loading on multiple factors. When cross-loadings are present they should differ more than 0.20, as recommended by Gaskin (2011). For reasons of clarity and comprehensibility all factor loadings smaller than 0.30 are suppressed in the pattern matrix as being insignificant.

greater than 0.70 point toward a majority of shared variance (0.7 *0.7 means 49% shared variance), explained by the two factors (Gaskin, 2012b). As can be seen from the factor correlation matrix presented in Table 6.2 below, none of the factor correlations exceeds the 0.70 threshold.

Table 6.2 Factor Correlation Matrix

Component	Netw Orient	Coord.	Tech Knowl	Market Knowl	Integr.	Knowl Tacit	Entre Orient	Env Turb	Knowl Compl	Sens.	Learn.	Knowl Speci
NetwOrient	1.000											
Coordinating	.426	1.000										
TechnoKnowl	.403	.508	1.000									
MarketKnowl	.271	.440	.449	1.000								
Integrating	.418	.545	.422	.195	1.000							
KnowlTacit	-.062	-.140	.026	-.146	.014	1.000						
EntreOrient	.241	.273	.402	.317	.275	-.046	1.000					
EnvTurb	.167	.039	.065	.002	.058	.258	.016	1.000				
KnowlCompl	.433	.630	.575	.434	.432	-.078	.313	.030	1.000			
Sensing	.467	.504	.343	.360	.302	-.208	.252	.145	.426	1.000		
Learning	.445	.536	.557	.359	.480	-.074	.400	.115	.470	.449	1.000	
KnowlSpeci	.219	.094	.242	.073	.194	.297	.080	.036	.127	-.061	.223	1.000

Extraction method: PCA; Rotation method: Promax with Kaiser Normalisation

Reliability relates to the absence of random errors within the measurement (Kinnear et al., 1993, Zikmund, 2003). Therewith, the reliability of the measurement accounts for accurate, consistent and predictable results (Kinnear et al., 1993), as a “reliable” measurement constantly loads on one factor (Gaskin, 2012b). By means of calculating Cronbach’s alpha (α) for each individual factor, reliability can be assessed during an EFA. Cronbach’s alpha has been widely accepted as a measure for the internal consistency of the factors (Cortina, 1993, Kline, 2005, Streiner, 2003), values above 0.7 are commonly regarded as adequate, enhancing the closer the value gets to 1 (Hair et al., 2010, Kline, 2005). As the value generally increases with the number of measurement items per factor, a minimum of three factors is recommended (Gaskin, 2012b). With the exception of Knowledge Specificy, internal consistency was achieved for all factors with Cronbach alpha values ranging between 0.762 and 0.941. The respectively low value ($\alpha = 0.606$) for Knowledge Specificy however indicates low internal consistency of this factor, leading to an elimination of the item V1602 during the CFA (refer to chapter 6.4.2).

In summary, an EFA was conducted first in order to identify the underlying factor structure of the observed variables. The results of the EFA showed an ideal loading pattern, with convergent, discriminant and content validity, as well as reliability ensured by high and constant loadings without any cross-loading problems. Given that the exploratory research step resulted in a very clear factor structure, the subsequent research step aims to confirm the factor structure and set up the measurement models for the latent constructs to be included in the final structural model.

6.4 Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) is a multivariate statistical method used to validate the factor structure of a set of observed variables. Contrary to the EFA, a preconceived structure on the outcome already exists, and hence the CFA is used for testing whether the predicted relationships between observed variables and their underlying latent constructs statistically exist, exposing its confirmatory character. Usually, researchers build on knowledge that emerged from theoretical or empirical findings or both in order to postulate a suggested factor structure a priori, which is then tested statistically a posteriori using confirmatory research methods (Backhaus et al., 2010). Hence, the CFA concerns the determination whether the number and composition of factors is "conform" to what is expected by theoretical considerations (Gaskin, 2012c). At the same time, by presenting the measurement models for the latent variables, the CFA represents the basis for the formulation of the structural equations and the analysis of the relationships between the latent variables with the help of SEM (Backhaus et al., 2010). Accordingly, SEM models always consist of two inter-related models: (a) the measurement model (resulting from the CFA) and (b) the structural path model (as presented in section 6.5) (Gefen et al., 2000).

The **measurement model** first and foremost determines the latent constructs that are used in the structural model, specifying the relationship between constructs and measures (Diamantopoulos et al., 2008), and ascertains which observed variables belong to each construct. During the factor analytical procedure, the exact loadings of each observed variable on the respective latent construct are estimated and the preconceived factor structure is tested (Gefen et al., 2000). Thus, the CFA aims to confirm the predicted relationships and sets up the final measurement model for the latent constructs to be included in the structural path model.

Based on the CFA results, the **structural path model** consequently tests the causal relationships between the latent variables. With that, the supposed causal and covariance relationships among the endogenous and exogenous latent constructs are estimated. At the same time the structural model includes the shared measurement error of these constructs in the calculation (Gefen et al., 2000).

The **Maximum-Likelihood (ML)-method** was used in this research, as it is the most commonly used technique for the estimation of both, testing the theoretical factor structure in the measurement model, as well as for testing the causal relationships in the structural model (Backhaus, 2010). One reason for its popularity is that the ML-method maximises the likelihood that the theoretical estimated correlation is represented by the observed correlation (Backhaus, 2010), as the method uses an iterative process to minimise the difference between the estimated and observed correlation matrix (Backhaus, 2010). However, there are also some restraints concerned with the use of the ML-method. A methodologically precondition for the application of the ML-method is the assumption of multivariate normality (Reinecke, 1999). As described in chapter 6.2.2, slight to moderate univariate and multivariate non-normality might be suggested in the obtained data. However, as a variety of recent simulation studies shows, the ML-method and its parameter estimates demonstrate to be relatively robust and stable against violations of normality as long as the sample size is large enough (n>200) (Anderson and Gerbing, 1984, Hair et al., 2010, Hoogland and Boomsma, 1998, Hoyle and Panter, 1995). For this reason, the use of the ML-method was justified for the estimation process for both the measurement and structural models.

6.4.1 Goodness-of-Fit Indices

Prior to presenting the measurement models, criteria for the evaluation of the model fit will be presented and discussed in this following chapter. Model fit relates to how well the postulated model "fits" the observed or estimated model. Good model fit is given, when the postulated model accounts for all major correlations and covariances between the variables in the dataset. In contrast if there is a significant discrepancy between the implied and obtained correlation or covariance matrices, then poor model fit is evident (Gaskin, 2012c). Beside the principal goodness of fit index (Chi-Square), a variety of alternate **goodness-of-fit indices** has been developed in the literature and can be calculated in AMOS to determine goodness of fit.

However, as there is a constant debate and change of knowledge about the appropriateness of individual indicators (Kline, 2005, Hu and Bentler, 1998, Marsh et al., 2004), and as the strength and weaknesses of different indices are still not sufficiently studied (Fan and Sivo, 2005, Jahn, 2007), researchers agree that there is not the one "best" index. Instead, the consideration of different, alternative indices is recommended (Hair et al., 2010, Bollen and Long, 1993, Marsh et al., 1996, Jahn, 2007). Hence, in order to ensure a thorough assessment and comprehensive reflection of the overall model fit, it was deemed valuable to employ a variety of different indices in this research. Commonly researchers distinguish between **absolute, incremental** and **parsimony fit indices** (Hu and Bentler, 1995), all of which supplement the principal Chi-Square (χ^2) statistic for model fit (e.g. Jahn, 2007). An overview of the fit indices applied for this research, their abbreviation along with their acceptable thresholds, is presented in Table 6.3, and will be discussed in more detail below.

As model fit is inversely related to sample size and the number of variables included in the model, the thresholds below should rather be seen as guidelines emerged from literature (Gaskin, 2012c). Notably, the calculation of the values also differs depending on the method applied, Maximum-Likelihood (ML) or Generalised-Least-Squares (GLS), while the GLS-method usually leads to higher values (Hu and Bentler, 1999). Being more adequate for model evaluation, the ML-method is applied in this research (Hu and Bentler, 1999), thus the thresholds reported below are based on the ML-method.

Table 6.3 Summary of Fit Indices Used to Assess Model Fit

Name	Abbreviation	Type	Acceptable level
Chi-Square	χ^2	Model Fit	$p > 0.05$
Normed Chi-Square	χ^2 /df	Absolute Fit Model Parsimony	$1.0 < \chi^2 / df > 3.0$
Goodness-of-Fit	GFI	Absolute Fit	GFI > 0.90
Adjusted Goodness-of-Fit	AGFI	Absolute Fit	AGFI > 0.90
Tucker-Lewis Index	TLI	Incremental Fit	TLI > 0.95
Comparative Fit Index	CFI	Incremental Fit	CFI > 0.95
Normed Fit Index	NFI	Incremental Fit	NFI > 0.95
Root Mean-Square Error of Approximation	RMSEA	Absolute Fit	RMSEA < 0.08 (not > 1)
Root Mean Squared Residual	RMR	Absolute Fit	RMR < 0.08 (not > 1)
Consistent Akaike Information Criterion	CAIC	Model Parsimony	No defined level

Sources: Byrne, 2001, Diamantopoulos and Siguaw, 2000, Hair et al., 2010, Hu and Bentler, 1998, Kline, 2005, Marsh et al., 1996

Absolute fit indices

Absolute fit indices calculate how good an a-priori-model is reproduced by the data set (derived from the fit of the implied and obtained covariance matrices) and do not use an alternative model for comparison reasons (Jahn, 2007).

The **Chi-Square (χ^2)** statistic of the model fit is the only statistical measure for the model fit (Hair et al., 2010). The p-value of the χ^2 is required to be non-significant ($p > 0.05$), only then evidence is given that “the actual and predicted input matrices are not statistically different” (Hair et al., 1998, p. 654) and hence that the proposed model fits the observed one. Due to the fact that the Chi-Square statistic is sensitive to sample size, a sample size of 100 to 200 is recommended by literature (Hair et al., 2010). Because non-normality and sample size impact the χ^2 statistic (Hair et al., 2010, Hu and Bentler, 1995, Marsh et al., 1996), additional indices were employed.

The **Normed Chi-Square (χ^2/df)** calculates the Chi-Square (χ^2) adjusted by the degrees of freedom (df) (Hair et al., 2010). There is no consensus in the literature when a ‘good’ fit is reached, yet recommended values ranging between 1 and 3 (Bollen 1989, p. 278) up to 5 (Arbuckle and Wothke, 1999, p. 399f.), with values below 1 representing an overfit of the model (Hair et al., 2010).

Another commonly used absolute fit index is the **Goodness of Fit Index (GFI)**, as well as the **Adjusted Goodness of Fit-Index (AGFI)** corrected by the degrees of freedom (df). Values for both the GFI and AGFI range between 0 and 1, while contrary to the Chi-Square statistics values close to 1 indicate a good model fit. As a rule of thumb, values greater than 0.9 indicate an acceptable model fit (Hair et al., 2010, Hoyle and Panter, 1995, Jahn, 2007). However Hu and Bentler (1998) point out that both GFI und AGFI are very sensitive to sample size. Moreover their values generally decrease in complex models, potentially leading to an unjustified rejection of the model (Anderson and Gerbing, 1984).

The **Root Mean-Square Error of Approximation (RMSEA)** is also given much attention as a measure of the misfit of a model. Accordingly, the RMSEA is also called “badness-of-fit index” (Kline, 2005). The RMSEA calculates the discrepancy between the postulated and the observed model divided by the degrees of freedom. Due to that, the RMSEA accounts for the parsimony of a model (as a complement to complexity) and therewith does not place a disadvantage on the simple and easy to interpret models (Jahn, 2007). While values for the RMSEA between 0.05 and 0.08 have been described as acceptable (Hair et al., 2010), good fit is given with values smaller than 0.05, with zero indicating the best fit. By contrast, values above 0.1 speak against the model (Browne and Cudeck, 1993).

Likewise the **Root Mean Squared Residual-Index (RMR)** informs about the “badness-of-fit” of a model. The RMR calculates the square root of the difference between the residuals of the observed and the hypothesised covariance matrix (Fan and Sivo, 2005). Thereby it is equivalent to the standard error calculated in a regression analysis (Jahn, 2007). Similar to the RMSEA, values for the RMR range from 0 to 1 with smaller values indicating better model fit. Models are regarded as showing good fit when values less than 0.05 are exhibited (Byrne, 2001, Diamantopoulos and Siguaw, 2000). However, values below 0.08 are still considered as acceptable (Hu and Bentler, 1999).

Incremental fit Indices

Incremental fit indices on the other hand derive from the comparison of the chi-square difference between a postulated model and a so called “baseline” model, which is more strongly restricted, as its variables are not allowed to correlate with each other (Hu and Bentler, 1998, Jahn, 2007). The **Tucker-Lewis Index (TLI)**, also called Non-normed fit index, accounts for the comparison between the model of interest and the baseline or null model (Diamantopoulos and Siguaw, 2000, Hair et al., 2010). In comparison to other incremental measures, such as the **Comparative Fit Index (CFI)** and the **Normed Fit Index (NFI)**, that both are “normed”, meaning that their values range between 0 and 1, the TLI can also show values greater than 1 (Diamantopoulos and Siguaw, 2000). Values above 0.95 are reported as acceptable, improving the closer the value comes to 1. Marsh et al. (1996) recommend the application of TLI and CFI as a result of their analyses of different incremental fit indices. The NFI, even though it is commonly used in research practice, tends to arrive at biased results, caused by its sensibility to sample size (Jahn, 2007). In this research all three indices were employed, with particular importance placed on the TLI and CFI, given their respective strengths, such as their appropriateness for research with smaller sample sizes and non-normality conditions (Hair et al., 2010, Lei and Lomax, 2005, Plewa, 2010).

Parsimony fit indices

Parsimony fit indices are relative fit indices that calculate the goodness of fit in proportion to the number of estimated parameters, in a way that simpler models are favored over more complex ones and thereby take parsimony of the model into account. Hence, parsimony fit indices address the problem that nearly saturated, highly complex models often depend to a high degree on the sample data, resulting paradoxically in better fit indices but less rigorous theoretical models (Mulaik et al., 1989, Crowley and Fan, 1997).

The **Akaike Information Criterion (AIC)** or the **Consistent** version of **Akaike Information Criterion (CAIC)** adjusted by sample size, is a frequently used measure for model parsimony (Akaike, 1974). As it accounts for the effects of sample size (Diamantopoulos and Siguaw, 2000, Kline, 2005), the CAIC was chosen for this research. Generally used as a comparative measure between different models estimated with the same data, the CAIC is also known as 'information criteria' index as it enables information about which of the suggested models is the most parsimonious (Hooper et al., 2007). Model parsimony increases with decreasing CAIC values (Diamantopoulos and Siguaw, 2000, Hair et al., 2010). Accordingly, the closer its value comes to zero, the more parsimonious is the model (Hair et al., 2010). However, as the indices are not normed a specific value range is not given and thus literature does not provide a threshold level other than that "the model that produces the lowest value is the most superior" (Hooper et al., 2007, p. 56). Notably, a minimum sample size of 200 is recommended by literature to ensure reliable measures for these indices (Diamantopoulos and Siguaw, 2000).

To summarise, a comprehensive overview and discussion of different indices applied in this research for the assessment of model fit were given in this section. By balancing out absolute and incremental fit indices with the parsimony of the model, a thorough assessment and comprehensive reflection of the model fit is ensured for the next research steps, when all indices are applied for the assessment of one-factor congeneric models (refer to the following chapter 6.4.2), the structural path model (chapter 6.5.3), as well as its re-specification (chapter 6.5.4).

6.4.2 One-Factor Congeneric Measurement Models

The one-factor congeneric measurement models, which represent the simplest form of measurement models, are presented in this chapter, along with the full measurement model used for the calculation of the composite scores for the latent constructs. These models were developed based on the suggested factor structure indicated by the EFA. In this confirmatory research step, both theoretical as well as empirical factors were considered, with the aim to achieve highly fitted, yet parsimonious measurement models (Kline, 2005), and therewith suitable composites for further analysis.

The individual one-factor congeneric measurement models were calculated using AMOS with goodness-of-fit and parsimony indices (refer to section 6.4.1) applied for the assessment of model fit. To identify whether all items load high on their respective construct, the variance of the latent construct was set to 1. A mandatory precondition for computing the measurement models is, that the degrees of freedom are above zero, which requires a higher number of observations than free parameters (Kline, 2005). Hence, to allow the computation of measurement models with only three items, based on a pair-wise parameter comparisons the variance of two residuals was set equal, as it is common practice in research (e.g. Plewa, 2010). Notably, the Bollen-Stine bootstrap technique with bootstrap samples set to 500 (as described in chapter 6.2.2) was performed and the respective p-value is provided.

In case the fit indices did not show acceptable fit, models were re-specified. Re-specification primarily concerned the elimination of items with small factor loadings, whereby a minimum of 0.5 is recommended by literature to ensure convergent validity (Steenkamp and van Trijp, 1991). Besides, in order to achieve more parsimonious models, modification indices for covariances were further consulted in some cases and provided suggestions for covarying error terms that are part of the same factor (Gaskin, 2012c). The resulting one-factor congeneric measurement models for each latent construct are presented in Appendix 6.3, along with their factor score weights and respective model fit indices.

In accordance to the acceptable threshold as described in chapter 6.4.1., all models show a good model fit. Moreover, all items show sufficiently high loadings on their respective constructs, with all beta values exceeding the recommended threshold of 0.5 (Steenkamp and van Trijp, 1991). Notably, while all values of the Normed Chi-Square (χ^2/df) are well situated below the critical value of 3 (Bollen, 1989), several values even lie below the value of 1, indicating a model overfit (Hair et al., 2010). As often seen in similar studies, a slight overfit in the congeneric measurement models is common (e.g. Plewa, 2010) and was deemed acceptable for this research due to the known effect of sample size on the χ^2 statistics (Hair et al., 2010, Hoyle and Panter, 1995). The consideration of parsimony in tandem with other goodness-of-fit indices was valuable for the assessment of the one-factor congeneric models and the determination of the number of indicators used for computing each construct. In sum, the overall goodness of fit, measured by means of a variety of absolute, incremental and parsimony fit indices, gave evidence that all models qualified for the calculation of composite scores and hypotheses testing in the final structural model.

The Full Measurement Model

After all one-factor congeneric measurement models were built and assed for quality, in a next step they were included in a **complete measurement model**, whereby covariances were drawn between all constructs, showing the following fit indices: While the χ^2/df (=1.514) and RMSEA (=0.050) indicated good model fit, the GFI (=0.826), TLI (=0.936), and CFI (=0.945) were close to, although did not meet their acceptable thresholds, whereby the AGFI (=0.788) and NFI (=0.855) indicated poor fit. However, given the good model fit obtained for the congeneric measurement models, a good fit for *all* indices computed for the full measurement model is neither assumed nor necessarily being achieved. The major purpose of the model evaluation rather is to test the measurement model for reliability and validity of measurement (Backhaus, 2008), by means of examining the extent of interrelationships and covariations among the latent construct (Schreiber et al., 2006). The measurement model is rather used to test for common method bias and measurement model invariance, as presented in the following chapters 6.4.4 and 6.4.5.

6.4.3 Construct Reliability and Validity (from CFA)

Similar to the procedure during the EFA, an assessment of the validity and reliability of constructs emerged from the CFA is required. Without having convergent and discriminant validity, as well as reliability established, moving forward to test the causal model would lead to useless results (Gaskin, 2012c). As already referred to in chapter 6.3.3, an assessment of the **validity** of the latent constructs, more specifically the convergent, discriminant and content validity (Lukas et al., 2004, Page and Meyer, 2000) is deemed crucial in order to approve that the measurement items "measure what they are supposed to measure, but also not measure what they are not supposed to measure" (Kline, 2005, p. 60).

Convergent validity refers to the correlation between the measurements items for the same construct (refer to chapter 6.3.3). Given that all factor loadings of the one-factor congeneric measurement models exceed the recommended threshold of 0.5, convergent validity was further assessed by means of the Average Variance Extracted (AVE). The AVE ($p_{VC)}$) for the construct η, with λ representing the i^{th} factor loading on the respective construct, is computed based on the following formula (Fornell and Larcker, 1981):

(1)
$$p_{vc(\eta)} = \frac{\sum_{i=1}^{p} \lambda_{yi}^{2}}{\sum_{i=1}^{p} \lambda_{yi}^{2} + \sum_{i=1}^{p} Var(\varepsilon_i)}$$

An acceptable level of convergent validity is given when the values for p_{vc} (η) are higher than 0.5 (Hair et al., 2010) meaning, that the measurement items account for a larger degree of variance than the measurement error (Diamantopoulos and Siguaw, 2000). Convergent validity is given for all constructs as all p_{vc} (η) values meet the respective criteria (as reported below in Table 6.5). Convergent validity confirms that the theoretically anticipated correlations between the individual measurement items and the respective construct are present.

Discriminant Validity in turn accounts for the distinctiveness between constructs (refer to chapter 6.3.3), revealing that the constructs are theoretically different and sufficiently uncorrelated. Given the context of this research, where theoretical considerations as well as empirical findings suggest the presence of moderate correlations among constructs (e.g. Pavlou and El Sawy, 2011), potential multicollinearity issues caused by inter-correlations among the DC constructs might be a problem. Therefore it was deemed extremely important to demonstrate discriminant validity among constructs in order to secure validity of the findings. As shown in the correlation matrix presented in Table 6.4, as expected moderate to high correlations appeared between Sensing, Learning, Coordinating and Integrating capacity.

Table 6.4 Correlation Matrix of Final Constructs

Component	Knowl Speci	Knowl Compl	Knowl Tacit	Techno Knowl	Market Knowl	Entre Orient	Env Turb	Netw Orient	Coord.	Integr.	Learn.	Sens.
KnowlSpeci	1.000											
KnowlCompl	0.475	1.000										
KnowlTacit	0.252	-0.048	1.000									
TechnoKnowl	0.266	0.682	-0.062	1.000								
MarketKnowl	0.304	0.422	-0.088	0.604	1.000							
EntreOrient	0.117	0.372	-0.084	0.41	0.371	1.000						
EnvTurb	0.031	0.114	0.28	0.107	0.107	0.04	1.000					
NetwOrient	0.351	0.526	-0.037	0.383	0.332	0.276	0.248	1.000				
Coordinating	0.37	**0.726**	-0.094	0.614	0.494	0.395	0.053	0.52	1.000			
Integrating	0.242	0.584	-0.085	0.418	0.331	0.316	0.097	0.479	**0.776**	1.000		
Learning	0.215	0.663	-0.207	0.609	0.51	0.433	0.167	0.566	**0.762**	0.531	1.000	
Sensing	0.139	0.48	-0.182	0.434	0.463	0.345	0.209	0.584	0.56	0.482	**0.712**	1.000

Given these high correlations, a further assessment of discriminant validity was deemed valuable. Following the Fornell/Larcker criterium, discriminant validity is given when the highest squared correlation between two constructs, and thus the squared variance (λ^2), is smaller than the Average Variance Extracted (AVE), calculated earlier by the p_{vc} score (Fornell and Larcker, 1981, Straub et al., 2004, Hair et al., 2010). The following Table 6.5 presents the highest shared variance (λ^2) and the AVE (p_{vc}) values for each construct.

Table 6.5 Convergent and Discriminant Validity Scores

Construct	Pvc (η)		highest λ^2
Sensing capacity	0.524	>	0.507
Learning capacity	0.736	>	0.581
Integrating capacity	0.688	>	0.602
Coordinating capacity	0.703	>	0.602
Market Knowledge	0.826	>	0.365
Technological Knowledge	0.672	>	0.465
Knowledge Tacitness	0.822	>	0.078
Knowledge Specificy	0.548	>	0.227
Knowledge Complementarity	0.736	>	0.527
Networking Orientation	0.746	>	0.341
Environmental Turbulence	0.603	>	0.078
Entrepreneurial Orientation	0.603	>	0.187

As all AVE (p_{vc}) values reported in Table 6.5 exceed the values for the highest shared variance (λ^2), discriminant validity is established for all constructs (Fornell and Larcker, 1981, Rokkan et al., 2003).

Content validity, as already explained in detail in chapter 6.3.3., was yet approved during the exploratory research step. Similar findings revealed during the CFA, whereby the theoretical anticipated correlations could also be empirically confirmed. For example, a high degree of Integrating capacity was expected and shown as being associated with a higher level of Learning and Coordinating capacity (Pavlou and El Sawy, 2011).

Reliability, as already addressed in chapter 6.3.3, accounts for the internal consistency of the measurement, and is closely related to the absence of random errors within the measurement (Kinnear et al., 1993, Zikmund, 2003). During a CFA the internal consistency can either be assessed by means of computing **Cronbach's alpha (α)** (see chapter 6.3.3) or calculating **Construct Reliability (p_η)** (Hair et al., 2010). The latter is estimated using information on factor loadings and error variances (Diamantopoulos and Siguaw, 2000) and is regarded as being more precise than Cronbach`s alpha as it is not sensitive to the number of constructs (Hair et al., 2010). The formula for estimating the construct reliability p for the construct η (with λ representing the i^{th} factor loading on its respective construct) is (Fornell and Larcker, 1981):

(2)
$$p_\eta = \frac{(\sum_{i=1}^{p} \lambda_{yi})^2}{(\sum_{i=1}^{p} \lambda_{yi})^2 + \sum_{i=1}^{p} \mathrm{Var}(\varepsilon_i)}$$

An acceptable level of construct reliability is given when p_η exhibit values higher than 0.70 (Fornell and Larcker, 1981, Hair et al., 2010). As shown by the respective values of Cronbach`s alpha **(α)** and Construct reliability presented in Table 6.6, all constructs show a high degree of internal consistency and construct reliability, especially considering the small number of items used for each construct.

Table 6.6 Reliability Measures

Construct	No. items	α	pη
Sensing capacity	3	0.762	0.767
Learning capacity	3	0.889	0.897
Integrating capacity	4	0.895	0.898
Coordinating capacity	4	0.903	0.904
Market Knowledge	3	0.866	0.934
Technological Knowledge	3	0.919	0.858
Knowledge Tacitness	3	0.931	0.932
Knowledge Specificy	2	0.707	0.708
Knowledge Complementarity	3	0.892	0.893
Networking Orientation	4	0.921	0.922
Environmental Turbulence	3	0.813	0.819
Entrepreneurial Orientation	3	0.818	0.820

With reliability and validity confirmed, the following section tests the presence of common method bias, before calculating the composite scores.

6.4.4 Common Method Bias (CMB)

Common method bias (CMB) is a potential bias in the dataset caused due to a systematic (external) measurement error that is influencing the correct measurement of the relationships between the constructs (Chang et al., 2010). CMB arises because of common method variance, which is the "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff et al., 2003, p. 879). Simply said, when the majority of the variance can be explained by a single factor, CMB is present (Gaskin, 2012c).

Researchers agree that CMB may be a concern, when a single source (e.g. self-report questionnaires within an online survey) is used for collecting data from the same participants, at the same time interval (Podsakoff and Organ, 1986, Chang et al., 2010). However, there is a constant debate on the likelihood and nature of CMB in self-reported data (Richardson et al., 2009), while some authors regard CMB as a common problem researchers are required to control for (e.g. Podsakoff et al., 2003), others refer to it as an 'urban legend' and consider any attempts made to control for CMB as "exaggeration and oversimplification of the true state of affairs'' (Spector, 2006, p. 230).

The most widely and traditionally used technique for testing common method variance is the **Harman's single-factor test**, which controls if the majority of variance in the data can be attributed to a single factor (Podsakoff et al., 2003, Chang et al., 2010). The basic assumption of the method is, if a substantial amount of common method variance exists, the variance extracted by the one single factor accounts for more than 50% of the variance in the model, this would indicate that CMB is an issue (Podsakoff et al., 2003). For using this method, all 38 items from each of the studies` constructs were included into an EFA, while the number of factors extracted was constrained to one (Gaskin, 2012c). The results of the unrotated one-factor solution were then examined and gave hints whether CMB is an issue or not. The results of the Harman`s single factor test show that only 38.57% of variance extracted is explained by the single factor, claiming that CMB is not a pervasive issue.

Despite its wide usage and apparent appeal, there are also several limitations reported for this method. First, it is criticised for being insensitive due to the fact that it is rather unlikely that a one-factor model will fit the data (Podsakoff et al., 2003, Chang et al., 2011). Furthermore, its explanatory power is restricted, as it only gives an indication of the existence of a CMB and does not statistically control for or partial out the common variance effects (Podsakoff et al., 2003). Hence, the method should be used rather as a “diagnostic technique” for “assessing the extent to which common method variance may be a problem” (Podsakoff et al., 2003, p. 879).

Besides a variety of other post hoc statistical methods - such as the correlational marker approach (Lindell and Whitney, 2001), the CFA marker approach (Williams et al., 2010), and the unmeasured latent method construct (ULMC) (William et al., 1989) - for testing CMB have been proposed, that allow the detection and correction of common method variance. However, there is a constant debate and change of knowledge among scholars on their appropriateness and efficiency. In a recent and comprehensive study about the appropriateness of those post hoc statistical methods, Richardson et al. (2009) revealed that there is hardly any benefit for any of the suggested methods as “all techniques produced highly inaccurate corrected correlations” (Richardson et al., 2009, p. 798). They conclude, that using any of those methods will “be no better than ‘throwing darts in the dark’”, while “leading researchers to falsely conclude CMV [common method variance] is not present and biasing their data or vice versa’’ (Richardson et al., 2009, p. 798). As findings revealed the potential risks associated with using these techniques, they were not used in this research.

6.4.5 Measurement Model Invariance

Before creating composite variables for being used in the structural path model, configural and metric invariance of the measurement model is tested during the CFA. **Measurement model invariance** ensures that the factor structure and loadings (refer to Appendix 6.3) that were previously tested on a single sample (using the complete dataset), are also sufficiently equivalent across different sub-sample groups (Vandenberg and Lance, 2000, Gaskin, 2012c). If measurement model invariance is not given, creating composite variables would be error-prone and may hinder meaning-ful interpretations, as the underlying factor structure does not account for the different groups (Gaskin, 2012c). Beside this, establishing measurement model invariance is crucial when a multi-group moderation test for the structural model is conducted in a subsequent analysis (Plewa, 2010). Thus, to test configural and metric invariance was deemed valuable in order to identify whether the final measurement model replicates well for each sub-sample group. A detailed description of the procedure used to test for configural and metric invariance is provided in Appendix 6.4.

As the results presented im Appendix 6.4 show, both, configural and metric invariance was established. While the chi-square difference test gave evidence that groups are different *at the model level*, metric invariance could be confirmed *at the path level*, meaning that groups are equivalent with regard to the overall factor structure. Hence measurement model invariance was supported, as the relationships between manifest indicator variables and the latent construct show to be the same across groups. These findings allow the computation of composite variables from the factor scores.

6.4.6 Composite Variables

Having construct reliability and validity as well as measurement invariance established for the one-factor congeneric measurement models, this chapter describes the procedure used for the calculation of the composite variables and justifies its use.

To ensure stable parameter estimation, in comparison to other multivariate methods SEM necessitates relatively large sample sizes, that should at least exceed 100 to 150 with reference to statistical stability (Anders and Gerbing, 1988, Lei and Lomax, 2005), with recommended sample sizes of 200 or higher (Hair et al., 2010). A general rule of thumb is that the ratio of sample size compared to the number of model parameters should be at least 5:1, preferably 10:1 (Hair et al., 2010, Kline, 2005). Under conditions of multivariate non-normality, as it is common in research practice (Byrne, 2001), an even higher ratio is recommended (Hair et al., 2010).

Although the sample size of 208 for this research would exceed the recommended 200, instead of a ‘true’ structural equation model with latent and observed variables included in the final model, composite variables are used in this research for two reasons. First, due to the fact that multiple items were used to measure each latent construct, the application and analysis of a ‘true’ structural model would involve a highly complex model if the latent constructs and observed variables were to be included, the sample size is not sufficiently large enough to make use of a ‘true’ structural equation model. Second, with the application of composite variables, which are mathematically calculated artefacts (Farris et al., 1992) usually calculated as a means of data reduction (Rowe, 2002), the number of analysed parameters could be decreased for the benefit of statistical stability, as they limit the conceivable effect of idiosyncrasies of individual components (Hulin et al., 2001). Hence, the usage of composite variables promotes the evaluation of complex models as well as stable parameter estimations, even when the sample size is relatively small (Hewett et al., 2002).

Correspondingly, composite variables were calculated for each latent construct based on the one-factor congeneric measurement models. Following Plewa (2009), the calculation of the composite variables followed a three step approach. In a first step, the one factor congeneric measurement models were created for every construct (as presented in chapter 6.4.2). Due to the fact that all measures loaded high on their respective factor and showed good model fit according to the calculation of the goodness-of-fit indices, the one-factor congeneric models were approved and the measurement instrument was verified as valid (Hau, 1995). Furthermore, to ensure that substantial and meaningful composite variables were obtained, convergent and discriminant validity and reliability was determined (as reported in chapter 6.4.3). Common method bias (chapter 6.4.4) and measurement model invariance (chapter 6.4.5) were tested thereafter for the same reason.

In a second step, factor score regression weights for all one-factor-congeneric models were calculated in AMOS and used for the calculation of composite scores (Jöreskog and Sörbom, 1989). While in accordance to Rowe (2002), different procedures can be applied for the calculation of composite variables, e.g. simple, unweighted, additive indices or factor scores, the latter was used in this research for the benefit of taking random measurement error as well as different factor loadings into account, instead of simply averaging the item scores. As a result, different indicators are allowed to contribute in different manners, which leads to a more realistic representation of the original data (Fleishman and Benson, 1987). Hence, to derive the proportional weighted scale scores, the factor score of each individual item was divided by the sum of factor score weights of the respective construct (Plewa, 2010).

In the third step, a new variable was computed in SPSS to lastly calculate the final composite score. First, the proportional weighted scales scores for each individual item were multiplied by the original value of the respective item (Rowe, 2002). The resulting scores for those items that related to the same construct, were then added up in order to derive the final composite scores for each construct (Plewa, 2010). To summarise, with the composite variables calculated as the final result of the CFA, they represent the basis for the formulation of the structural path model for analysing the causal relationship between the constructs.

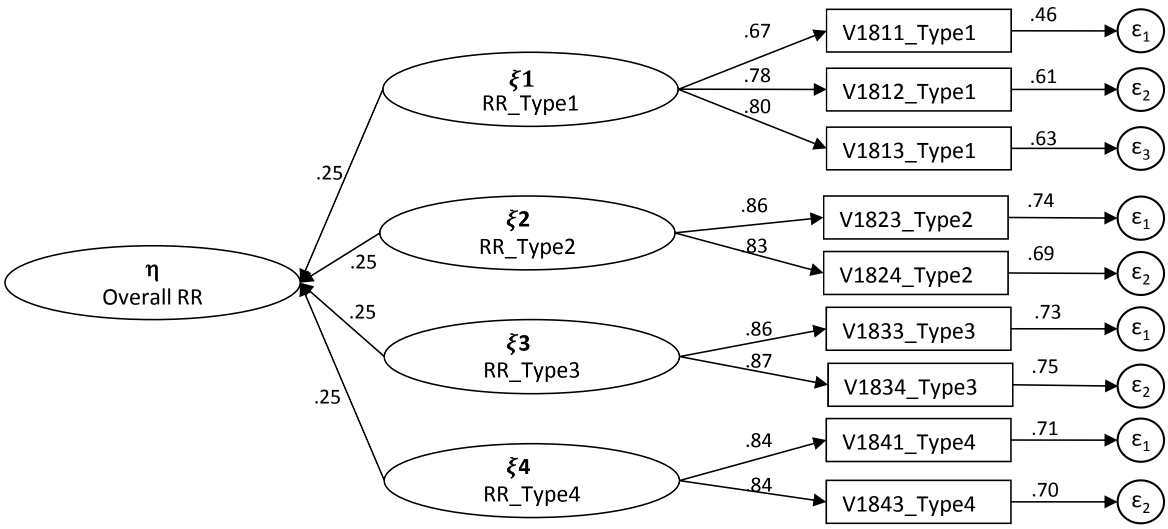
6.4.7 Second-Order Formative Construct

Prior formulating the structural path model, in a last pre-processing step this section outlines a different procedure used for the calculation of the formative construct, that was employed to measure the outcome variable RR. Thus, in contrast to all other constructs used in this research which are conceptualised as first-order reflective constructs, RR is formed by the four different types of RR and thus conceptualised as a second-order formative construct (refer to chapter 5.3.2 and 5.3.3).

For its computation first, one-factor congeneric measurement models were calculated for the first-order reflective measurement models, following the procedure as described in chapter 6.4.2. The RR measures, however, revealed problematic in regard to discriminant validity (as rather strong correlations emerged between the items measuring the four different types of RR), leading to the elimination of several items. As a consequence, only two items remained for the first-order constructs used to measure Type 2, 3 and 4, while three items remained for the measurement model for Type 1. Those measurement difficulties of the RR constructs may be related to the research field, especially as both interviews as well as the questionnaire pre-test indicated that respondents were not familiar with the nomenclature of RR and the respective items. Despite changes in the wording of the individual items, this unfamiliarity may cause measurement difficulties as already indicated by previous works in this field (e.g. Zahra and Wiklund, 2002). However the strong reliability scores for the two-item constructs suggest their suitability for further analysis. Moreover, as all remaining items for each individual construct relate to similar activities (while addressing different resources and outcomes) they qualified for being used to form the second-order formative model of RR. Notably, by means of calculating the first-order constructs "the indicators of the construct can still be individually evaluated based on their specific contributions to the construct by evaluating their path weights" (Cenfetelli and Bassellier, 2009, p. 690).

Having built the first-order reflective constructs, these models were used in a second step to form the **second-order formative** construct. Therefore an aggregation heuristic was used. As suggested by Lee and Cardogan (2013) for the weighting of formative constructs, researchers can either estimate weights by means of statistical algorithms (e.g. PLS) or by fixing the relative weightings of the formative dimensions to its "true value" using the aggregation heuristic that is part of the construct definition (Hardin et al., 2011). Therefore, each dimension forming the multidimensional construct and its respective weightings should be specified a priori, given that the theory concerning the construct provides sufficient theoretical rationale to "prescribe the exact algebraic relation between the multidimensional construct and its dimensions" (Law et al., 1998, p. 751). According to this research`s definition of RR, each Type (1, 2, 3 and 4) is regarded to be similar important for building the overall construct. Therefore, RR is constituted as a simple equally-weighted linear composite of its constituent dimensions. Unlike statistical weighting procedures, the aggregation heuristic used here is recommended in the literature as a more appropriate method allowing the estimation based on theoretical considerations and giving more transparency to the computation of multidimensional constructs and thus comparability of research findings (see Lee and Cardogan, 2013). Figure 6.2 illustrates the measurement model used to measure RR along with its respective path weights.

Figure 6.2 Second order-formative Construct – Measurement Model Resource Recombination



Having both the composite variables (6.4.6) as well as the formative construct (6.4.7) calculated, in a subsequent research step they were included in the structural path model in order to finally test the causal relationship between constructs. This research step is regarded as the core of SEM and will be outlined in the following section.

6.5 The Structural Path Model

This section outlines the structural path model, including hypotheses testing and model re-specification. The **structural path model**, comprises the second core component in SEM, where the causal relationships between the constructs are tested. The structural model displays the inter-relationships among the endogenous and exogenous constructs in the proposed model as a succession of structural equations, akin to a regression-analytical approach (Schreiber et al., 2006), but at the same time including the shared measurement error of these constructs into the calculation (Gefen et al., 2000).

6.5.1 Model Identification

Before testing the proposed structural path model, the model has to be identified. A model is said to be identified if a value can be estimated for every parameter in the model (Backhaus, 2010). An imperative for model identification therefore is, that the overall model has got a unique solution (Breckler, 1990, Diamantopoulos and Siguaw, 2000), which requires two conditions to be fulfilled: (1) the number of observations is equal or more than free model parameters, and (2) every unobserved construct is assigned a scale (Kline, 2005).

Different forms of identification exist: a model may be empirically *under-identified*, *just-identified* or *over-identified* (Kline, 2005). A model is regarded as under-identified or not identified, if condition (1) is not fulfilled, because this makes a unique solution theoretical impossible. At the same time, while models that are just-identified or over-identified are regarded as identified models and therefore fulfilling condition (1), whereas the just-identified model is constituted by an equal number of parameters and observations, while in contrast the over-identified model is characterised by more observations than parameters (Kline, 2005). All models used in this research meet the fundamental conditions of identification. Moreover, due to the fact that the models are over-identified and thus positive degrees of freedom exist, the scientific use of the models is given (Kline, 2001).

6.5.2 Multivariate Assumptions

The stable application of structural path models depends on a range of multivariate assumptions (Hair et al., 2010). Beside multivariate normality as already discussed in chapter 6.2.2, linearity of all relationships, the absence of multicollinearity and homoscedasticity of data are important assumptions for the application of SEM.

Linearity refers to "the consistent slope of change" that illustrates the relationship between the independent (endogenous) variable and the dependent (exogenous) variable (Gaskin, 2012a). Being a covariance-based SEM algorithm, the ML-method applied in this research postulates linear relationships among variables (Reinecke, 1999). Hence, if the relationships between the dependent and independent variables were radically inconsistent, this would hinder the application of SEM analyses (Gaskin, 2012a). To test the assumption of linearity, curve estimation was conducted for all proposed relationships in the proposed model to determine, if all relationships could be assumed to be linear in order to be tested using a covariance based SEM algorithm (Gaskin, 2012a). The results showed all proposed relations to be linear, with the exception of the relation between Knowledge Tacitness → RR, as well as Knowledge Origin → RR, both being used to control for specific characteristics of the resource base in the model. For the former the relationship between the variables indicated to be a cubic or quadratic function rather than linear, while the latter appeared inconsistent throughout. As already outlined before there are many reasons for a non-linear relationship to be suggested (e.g. interaction effects between the controls and RR as outlined in chapter 3.3). Therefore and for the reason that both variables (Tacitness and Origin) were solely used as controls in the model, the violation of the linearity assumption was not regarded as problematic.

Multicollinearity is given when two or more independent (endogenous) variables are highly correlated among themselves, meaning that one variable can be linearly predicted from the other (Backhhaus, 2011). While small and moderate degrees of multicollinearity are reported as common in research practice (Backhhaus, 2011), a high degree of multicollinearity is undesirable as in consequence the impact of the individual variables on the dependent variable tends to be less precise (Hair et al., 2010, O'Brien, 2007) A widely used method for determining whether multicollinearity is an issue or not, is the calculation of the variance inflation factor (VIF) for multicollinearity (Backhaus, 2011). Different thresholds are reported in the literature, with VIF values higher than 5 up to 10 (O`Brien, 2007, Backhaus, 2010) indicating a multicollinearity problem. As all VIF values for this research lie below 3, the critical thresholds alluding multicollinearity are not exceeded for this research (O`Brien, 2007, Hair et al., 2010), giving evidence that multicollinearity is not an issue.

Homoscedasticity of the data is a further pre-assumption for the application of SEM. Homoscedasticity is given when the variable`s residuals (or errors) have a constant variance among the dataset (Backhaus, 2010), meaning that the variance exhibits consistently across different levels of the variable (Hair et al., 2010). By contrast, heteroscedasticity exists if the errors or residuals do not have a constant variance among the data set (Backhaus, 2010). Given that interaction (moderation) effects between the variables are expected in this research model, homoscedasticity of the data is not assumed for this research. This is capped by research praxis, where heteroscedastic data is often found when the data is moderated by different groups (Gaskin, 2012a).

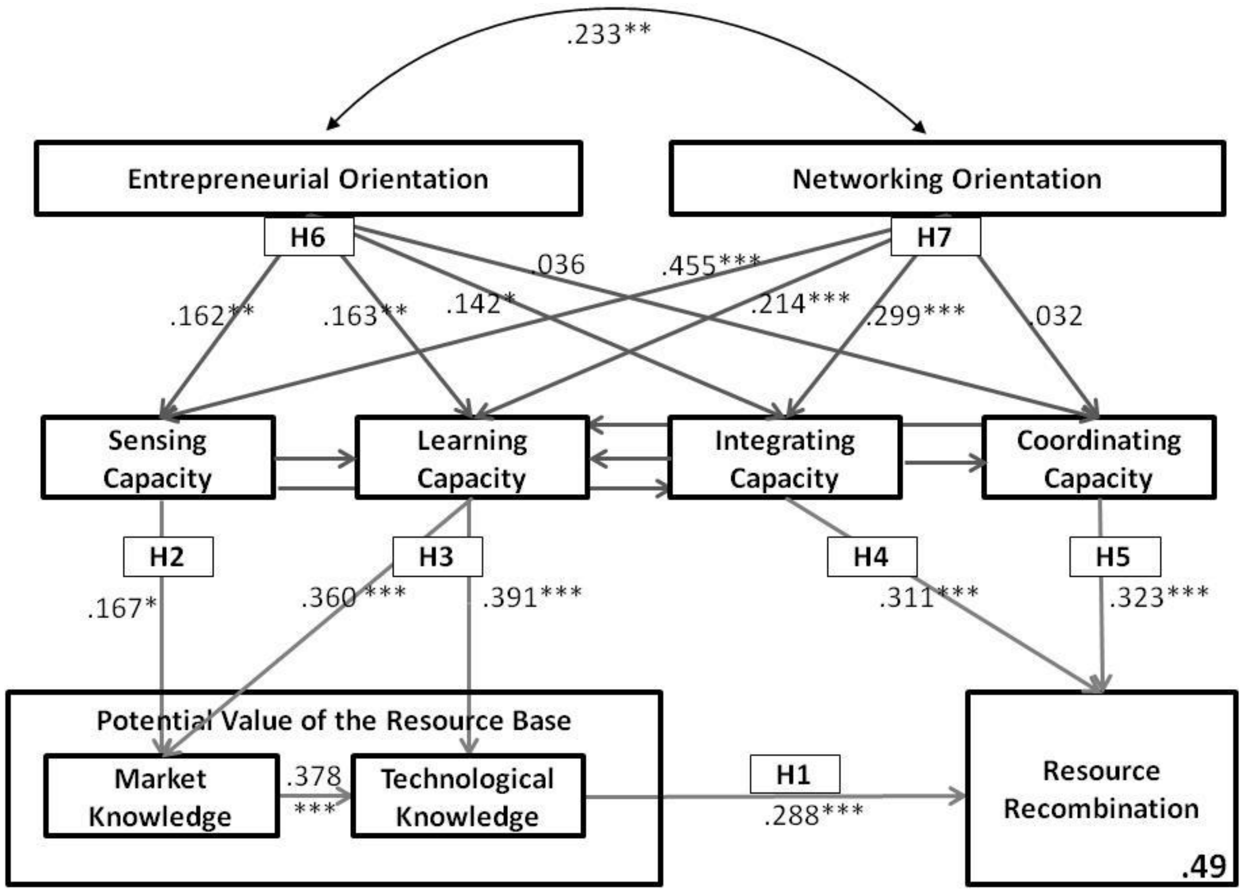
In brief, prior to testing the structural model a variety of multivariate assumptions as linearity, (the absence of) multicollinearity and heteroscedasticity were discussed and tested using the data, whereby the results indicated towards a stable application of the SEM methods.

6.5.3 The Structural Path Model

After the identification of the model and the test of all multivariate assumptions, finally the structural path model is presented and its overall model fit assessed. For this purpose, the conceptual model and the proposed interrelationships among the endogenous and exogenous constructs as developed based on the literature review and the preliminary qualitative research step were tested using AMOS.

Figure 6.3 presents the structural path model detailing hypotheses H1 to H7 and shows the estimated model fit indices for the model. Prior to testing the hypotheses however, an assessment of the overall model fit was conducted. A thorough assessment and comprehensive reflection of the model fit is ensured by the employment of a variety of different goodness-of-fit indices. The indices along with their acceptable thresholds were presented in chapter 6.4.1 and have already been employed for the assessment of the one-factor measurement models.

Figure 6.3 Conceptual Structural Path Model



χ^2 Chi-Square value	49.909	Tucker-Lewis Index (TLI)	0.898
Degrees of freedom	15	Comparative Fit Index (CFI)	0.957
p value	0.002	Normed Fit Index (NFI)	0.942
χ^2/ df value	3.327	Root Mean Squared Residual (RMR)	0.087
Goodness-of-Fit (GFI)	0.952	Root Mean-Square Error (RMSEA)	0.106
Adjusted Goodness-of-Fit (AGFI)	0.854	Consistent Akaike Information Criterion (CAIC)	240.0

Even though the conceptual model was based on a thorough literature review of the resource- and competence based literature and the causal relations were additionally confirmed by qualitative research findings, not all goodness-of-fit indices showed an acceptable model fit as shown in Figure 6.3. While the GFI (=0.952) and CFI (=0.957) indicated a good fit, the χ^2/df (=3.327), AGFI (=0.854), TLI (=0.898), and NFI (=0.942) were close to, however did not meet the acceptable thresholds, and this was not supported by a significant χ^2 ($p<0.05$) and an RMSEA value of 0.106. In particular the RMSEA is notably higher than the accepted level for this research (0.08), reflecting a poor fit for all values above 0.10 (Byrne, 2001).

The proposed model explains 49% of the variance in RR performance. Hence, despite the fact that some indicators point to a good model fit, an investigation of potential modification indices was deemed valuable to achieve a better fitting and more parsimonious model.

6.5.4 The Re-specified Structural Path Model

The conceptual structural path model was re-specified with the aim of achieving a more parsimonious, well-fitting model. Many authors have argued that it is unlikely for the conceptual model to reveal the best or most parsimonious representation of the logical structure of the data, and therefore often it requires a modification of the model (Anderson and Gerbing, 1988, Baumgartner and Homburg, 1996, Hoyle and Panter, 1995, Plewa, 2010). Hence, it was legitimated that, when different causal relationships are conceivable, an evaluation of alternatives is an established mean to further improve a structural model (Jahn, 2007). Thus, for this research a stepwise approach for model re-specification was chosen in order to achieve a more parsimonious model (Kaplan, 1990, Medlin, 2001, Plewa, 2010).

Modification indices were consulted as they offered "suggested remedies to discrepancies between the proposed and estimated model" (Gaskin, 2012c). A modification index for a parameter is referred to as "an estimate of the amount by which the discrepancy function would decrease if the analysis were repeated with the constraints on that parameter removed" (Jöreskog and Sörbom, 1989), in other words, it "shows the minimum decrease in the model's Chi-squared value if a previously fixed parameter is set free" (Diamantopoulos and Siguaw, 2000, p. 108). Therefore, the higher the value of a modification index for a specific path to be included in the model, the higher the potential of improvement in regard to the model fit (Kline, 2005). Modification indices were consulted, along with their expected estimate for parameter change, which accounts for the amount by which a parameter would positively or negatively change in the model if the constraints on it were removed (Byrne, 2001, Jöreskog and Sörbom, 1989, 1996).

Following the assessment of the conceptual structural model, the analyses of modification indices and parameter changes displayed the value of adding two additional paths, namely one between Entrepreneurial Orientation → Market Knowledge, and the other between Networking Orientation → RR. At the same time it was deemed essential to base any decision concerning the re-specification of the model not solely on statistical considerations, but also on theoretical and content-wise considerations (Anderson and Gerbing, 1988, Diamantopoulos and Siguaw, 2000, Plewa, 2010). Notably, as the aim was not to find the "best" fitting model, not all modifications indices were addressed, but only those that were theoretically grounded, were revised (Gaskin, 2012d). The statistical significant direct effect Entrepreneurial Orientation has on Market Knowledge ($p<0.05$) as well as Networking Orientation has on RR ($p<0.001$), and the potential integration of the two paths in the re-specified model were thus assessed based on existing theory and logical content.

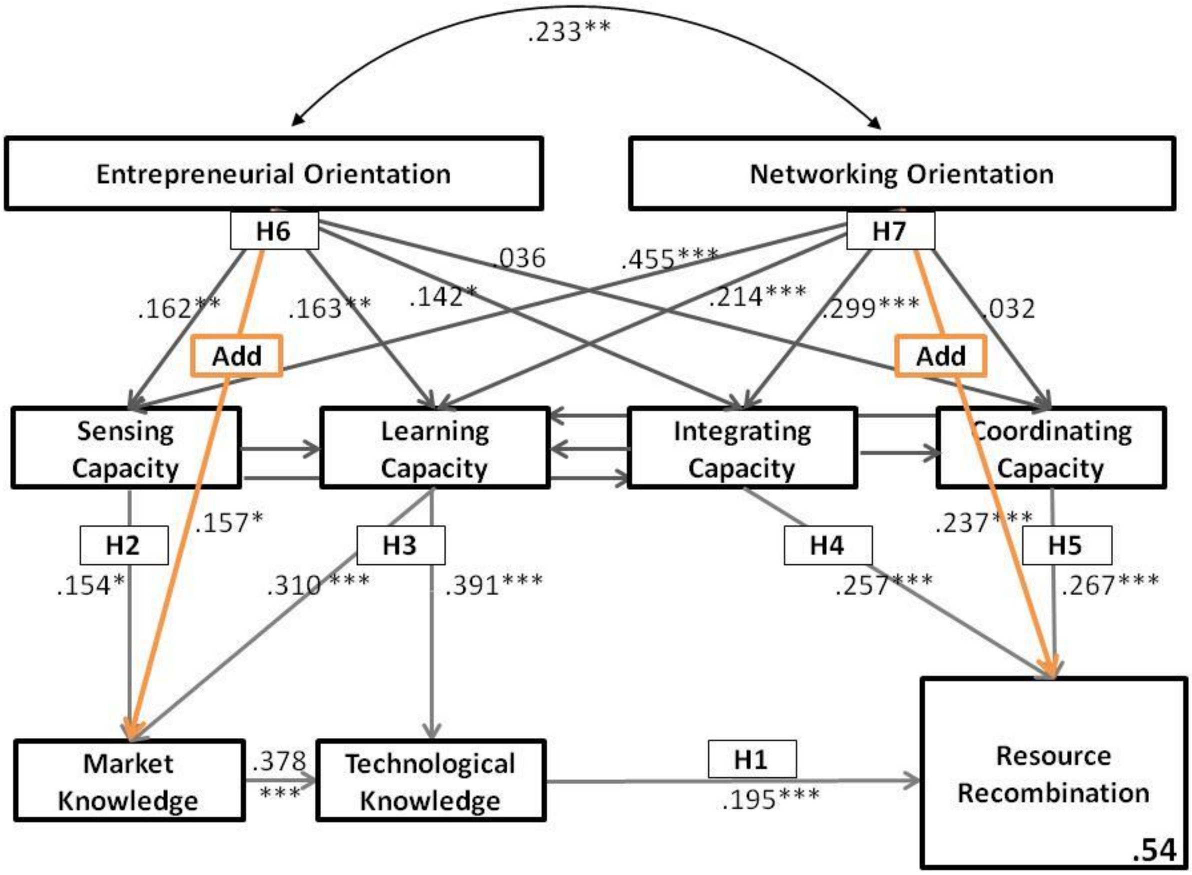
First, investigating the identified path between **Entrepreneurial Orientation and Market Knowledge**, EO as defined in this research is regarded as a combination of *proactiveness*, *innovativeness* and *risk-*

taking (e.g. Wiklund, 1999), which promotes the firm`s willingness to capitalise on new opportunities by engaging in entrepreneurial activities (e.g. Wiklund, 1999, Wiklund and Shepherd, 2000). A high EO thus is positively associated with the *ability* to sense and seize new opportunities and revamp the existing resource base with new knowledge (Sensing and Learning capacity), meanwhile it will also proactively contribute to the development of knowledge about markets and customers itself. Not surprisingly, there is also a significant direct effect between EO and Market Knowledge to be found in the data. Hence, the additional direct path helps specifying that EO not only *indirectly* influences the development of Market Knowledge through Sensing and Learning capacity, but also *directly* affects the development of Market Knowledge. While being logically consistent, it is also consistent with literature, where support can be found by empirical research confirming the contingent relation between EO and knowledge based resources and performance (Wiklund and Shepherd, 2000). These findings are complemented by the argument by Chockburn and colleagues (2000), who propose that EO can help to explain the managerial processes on the one hand and provides firms the ability to utilise their knowledge based resources on the other hand (Wiklund and Shepherd, 2000).

Likewise the identified path between **Networking Orientation and RR** can be explained by its conceptualisation and measurement. As NO is defined in this research as "the extent to which a firm's business strategy stresses effective and efficient location of network partners, management of network relationships, and improvement of network performance" (Mu and Di Benedetto, 2011, p. 341), it is embedded in a firm`s interactions with external partners and serves as significant source for new external knowledge and resources (Isobe et al., 2008, Peng and Delios, 2006, Mathews, 2002). Thus, while NO is rather orientated towards the external resources, Coordinating capacity is primarily directed towards the coordination of internal resources. Given these different directions, a high Networking capacity does not automatically lead to a higher internal Coordinating capacity, but can foster RR in firms by bringing in new resources. Moreover recent research findings suggest that "if firms are overembedded with strong [internal] network ties without building external network ties with divergent knowledge and information sources, networking can have a negative impact on innovation performance" (Mu and Di Benedetto, 2011, p. 342). Thus, emphasis should be given to the firm`s capabilities to also orchestrate their networks and external sources (Mu and Di Benedetto, 2012), e.g. through the development of a high Integrating capability to extract value. This is especially relevant as research findings suggest that "as a firm's networking capability increases, it should be able to increase its ability to purposefully create, extend, modify its resource configurations, and ultimately improve its marketing and technological capabilities for effective commercialisation of new products" (Mu and Di Benedetto, 2012, p. 7). Given these theoretical underpinnings the strong and positive *direct* effect NO has on RR supports the emphasis given by network theory and its underlying idea, that firms which are accessible to external sources through networks, alliances and partnerships are being more capable of external resources to enlarge their existing pool of resources available to extract value. Hence the direct link between NO and RR can be justified.

Based on these content-wise considerations, the two additional paths were added to the final model. Following the call for more transparency in reporting re-specification in regard to predicted and "discovered" paths (Hoyle and Panter, 1995), Figure 6.4 presents the final re-specified model with its original and added paths. The parameter estimates and model fit indices, thus enable a comparison to the conceptual model.

Figure 6.4 Re-specified Structural Path Model



χ^2 Chi-Square value	26.366	Tucker-Lewis Index (TLI)	0.955
Degrees of freedom	13	Comparative Fit Index (CFI)	0.984
p value	0.090	Normed Fit Index (NFI)	0.969
χ^2/ df value	2.028	Root Mean Squared Residual (RMR)	0.061
Goodness-of-Fit (GFI)	0.973	Root Mean-Square Error (RMSEA)	0.070
Adjusted Goodness-of-Fit (AGFI)	0.908	Consistent Akaike Information Criterion (CAIC)	229.1

As the goodness-of-fit indices show, a good overall model fit as well as a high level of parsimony could be established based on only slight modifications of the model, leading to a non-significant χ^2 of 26.366 (p=0.09), and a RMSEA value (=0.070) within the acceptable range. Similarly, all other fit indices indicate a high degree of goodness-of-fit (χ^2/df =2.028, GFI=0.973, AGFI=0.908) or respectively no badness-of-fit (RMR =0.051), while also the incremental fit indices (TLI=0.955, CFI=0.984, NFI=0.969) showed excellent values for the model fit. Even the CAIC value improved from

240.036 for the conceptual model to 229.167 for the re-specified model, indicating a higher level of parsimony for the re-specified model, despite of two additional paths. The proposed (re-specified) model explains 54% of the variance in RR performance.

In brief, with the aim of achieving a more parsimonious, well-fitting model, the structural path model was re-specified by means of statistical and theoretical considerations as it is common in research practice (e.g. Plewa, 2010). The re-specification of the conceptual model led to the addition of two paths, the first was added between EO and Market Knowledge, and the second between NO and RR. Worth noting, as opposed the principal nature of SEM, the procedure of model re-specification is not confirmatory but exploratory in nature (Byrne, 2001, Diamantopoulos, 1994). Whereas only slight modifications were made, the re-specified path model should be validated with a further, independent sample in the future (Diamantopoulos, 1994, Hoyle and Panter, 1995, Plewa and Quester, 2007, Plewa, 2009). Given the achieved good overall model fit, the model qualified for being used for hypotheses testing in the further analyses. The findings regarding the path coefficients and hypotheses support are detailed in the next chapter.

6.5.5 Hypotheses Support

As the local and global fit indices revealed a good model fit, hypotheses could finally be tested. When the relationship between two constructs is significantly different from zero and shows the expected direction (positive or negative relationship), the proposed hypothesis is regarded as being confirmed (Jahn, 2007). The proposed causal and covariance relationships among the endogenous and exogenous constructs were estimated using AMOS. Findings regarding standardised effects and the support of hypotheses are provided in Table 6.7.

The table incorporates the **standardised direct effect,** also referred to as path coefficient or beta coefficient and presented in the structural path model (Figure 6.4), as well as the **standardised indirect effect**. Furthermore, the aggregate of both effects builds the **standardised total effect**, which comprises the complete influence one variable has on another variable, throughout all conceivable relationships with additional constructs (mediating variables). A consideration of standardised total effects is regarded as valuable as it enables a better understanding of the causal relationships in holistic and complex models (Jahn, 2007). Furthermore, the **critical ratio** and the **level of significance** of the direct effect are presented in Table 6.7. In case that there was no direct relationship theorised between two constructs, only the indirect effect is reported, the respective hypotheses H1(1), H2 and H3, and their levels of significance will be subject of further investigation in the mediation analysis (chapter 6.6). For reasons of transparency the respective results for the original conceptual model are provided in Appendix 6.5.

Table 6.7 Standardised Effects, Critical Ratios and Hypotheses Tests

Hyp.	Independent (endogenous) Variable	Dependent (exogenous) Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	Techno. Knowledge	RR	0.195	0.000	0.195	3.387***	YES
H1(1)	Market Knowledge	RR	n.p.	0.063	0.063	*refer to chapter 6.6*	
H2	Sensing capacity	RR	n.p.	0.185	0.185	*refer to chapter 6.6*	
H2a	Sensing capacity	Market Knowledge	0.154	0.127	0.281	2.056*	YES
H3	Learning capacity	RR	n.p.	0.225	0.225	*refer to chapter 6.6*	
H3a(1)	Learning capacity	Techno. Knowledge	0.391	0.117	0.508	6.614***	YES
H3a(2)	Learning capacity	Market Knowledge	0.310	0.000	0.310	4.000***	YES
H2b/3b	Market Knowledge	Techno. Knowledge	0.378	0.000	0.378	6.393***	YES
H4	Integrating capacity	RR	0.257	0.171	0.428	3.816***	YES
H5	Coordinating capacity	RR	0.267	0.000	0.267	3.568***	YES
H6a	EO	Sensing capacity	0.162	0.000	0.162	2.653**	YES
H6b	EO	Learning capacity	0.163	0.095	0.258	3.081**	YES
H6c	EO	Integrating capacity	0.142	0.036	0.178	2.278*	YES
H6d	EO	Coordinating capa.	0.036	0.193	0.229	0.799	NO
H7a	NO	Sensing capacity	0.455	0.000	0.455	7.430***	YES
H7b	NO	Learning capacity	0.214	0.246	0.459	3.545***	YES
H7c	NO	Integrating capacity	0.299	0.100	0.399	4.319***	YES
H7d	NO	Coordinating capa.	0.032	0.382	0.414	0.645	NO
Add	NO	RR	0.237	0.259	0.496	4.302***	YES
Add	EO	Market Knowledge	0.157	0.105	0.262	2.429*	YES

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level
n.p.: not proposed, only an indirect effect was proposed and tested (refer to chapter 6.6.)

As presented in Table 6.7, the results of the structural path analysis provide support for the majority of hypotheses, while only two hypotheses had to be rejected due to non-significant relationships. Hence the vast majority of proposed causal relationships between DCs, their antecedents, the resource base and the outcome variable of RR could be confirmed. The specific hypotheses, their path coefficients and significance levels are discussed in more detail in the following.

Hypotheses relating to the Interrelationship between the Resource Base and RR

Proposition 1: A high valuable resource base (Market and Technological Knowledge) is positively associated with RR in firms.

H1: *Technological Knowledge has a direct, positive effect on RR.*

Strong support emerged for the impact of a high valuable resource base in terms of Market and Technological Knowledge on the development of RR in firms. **Technological Knowledge** (breadth and depth) has a strong, positive and direct effect on RR with a beta coefficient of 0.195 ($p < 0.001$), thus supporting H1.

H1(1): Market Knowledge has an indirect, positive effect on RR, through Technological Knowledge.

The association between Market Knowledge and Technological Knowledge was confirmed highly significant ($p<0.001$) with a beta coefficient of 0.387. Furthermore, in line with what theory suggested **Market Knowledge** (breadth and depth) does not have a direct effect on RR, instead the results indicate that Market Knowledge has a weak positive, indirect effect on RR through Technological Knowledge (ß = 0.063). The results in Table 6.7, however, do not yet give indications about the type and significance of this indirect effect, thus a more detailed investigation of H1(1) is provided by means of mediation analysis in chapter 6.6.

Hypotheses relating to the Interrelationship between DCs and RR

Proposition 2: A firm`s overall DC is positively associated with the amount of RRs in firms due to both building and exploiting the potential value of the resources base.

H2: *A high Sensing capacity is positively associated with RR, through Market and Technological Knowledge.*

H3: *A high Learning capacity is positively associated with RR, through Market and Technological Knowledge.*

Sensing capacity and Learning capacity were both found to be positively associated with the development of high Market and Technological Knowledge, and thus RR, supporting H2 and H3. The results show that **Sensing capacity** directly contributes towards building Market Knowledge (ß = 0.154), significant at a 0.05 level. Notably, this relatively weak, yet significant direct effect of Sensing capacity on Market Knowledge increases considerably to a beta coefficient of 0.281, when taking indirect effects through Learning into account. At the same time, and in line with the theoretical considerations as presented in chapter 3.4.1.2, no direct effect between Sensing capacity and Technological Knowledge could be found. Instead, evidence is given for an indirect contribution of Sensing capacity on Technological Knowledge through building Market Knowledge and through enhancing the firm`s Learning capacity.

Learning capacity on the other hand, was found to positively and directly contribute towards both, building Market Knowledge (ß = 0.310) and Technological Knowledge (ß = 0. 391), and through that indirectly RR (as confirmed by H1 and H1 (1)). Both effects are significant at a 0.001 level.

Moreover, as the results in Table 6.7 show, the suggested indirect effects of Sensing capacity (ß = 0.185) and Leaning capacity (ß = 0.225) on RR through the resource base emerged relatively strong and positive, confirming H2 and H3. These findings give already indications towards a proposed mediating role of Market and Technological Knowledge on the relationship between both, Sensing and Learning capacities and RR. However, to give evidence to the type and level of significance of these indirect effects, a more detailed investigation of these causal sequences (H2a, H2b, H2c) and (H3a, H3b, H3c) is deemed necessary and will be provided in the following chapter 6.6.

H4: *A high Integrating capacity is positively associated with RR.*

H5: *A high Coordinating capacity is positively associated with RR.*

In accordance with theoretical considerations as presented in chapter 3.4.1.4 and 3.4.1.5 both, Integrating and Coordinating capacity were found to be positively associated with RR, supporting H4 and H5. The results show a strong and positive direct effect of **Integrating capacity** on RR with a beta coefficient of 0.257 ($p<0.001$). Notably, this direct effect was enhanced considerably when taking indirect effects of Integrating capacity into account, to a strong total effect of 0.428, supporting H4.

Likewise, **Coordinating capacity** is positively and directly associated with RR with at beta coefficient of 0.267 ($p <0.001$), supporting H5. For a further investigation of the moderation effect of Integrating and Coordinating capacity on the relation between Technological Knowledge and RR (as suggested in H4a and H5a), a more detailed analysis is required and will be presented in chapter 6.7.

Important note: In this research DCs were operationalised as distinct but related constructs. Therefore it was suggested that also interrelations between the four DCs are to be found (refer to chapter 3.4.1.6). As these interrelations are constituent part of the structural model the interrelations between Sensing, Learning, Integrating, and Coordinating capacities are detailed and discussed in Appendix 6.6.

Hypotheses relating to Entrepreneurial and Networking Orientation as Antecedents for DCs

Proposition 3: Entrepreneurial Orientation and Networking Orientation act as antecedents for the development of a firm`s DCs.

H6: *A high degree of Entrepreneurial Orientation is positively associated with the development of a firm`s DCs.*

H7: *A high degree of Networking Orientation is positively associated with the development of a firm`s DCs.*

The support for hypotheses regarding the impact of Entrepreneurial Orientation as well as Networking Orientation on the DC was mixed. As presented in Table 6.7, the results show that **Networking Orientation** has strong direct and total effects on Sensing, Learning and Integrating capacity (with positive and significant beta coefficients 0.455, 0.214 and 0.299, respectively) supporting H7a, H7b and H7c. However, no direct effect emerged on Coordinating capacity ($p>0.05$), leading to the rejection of H7d.

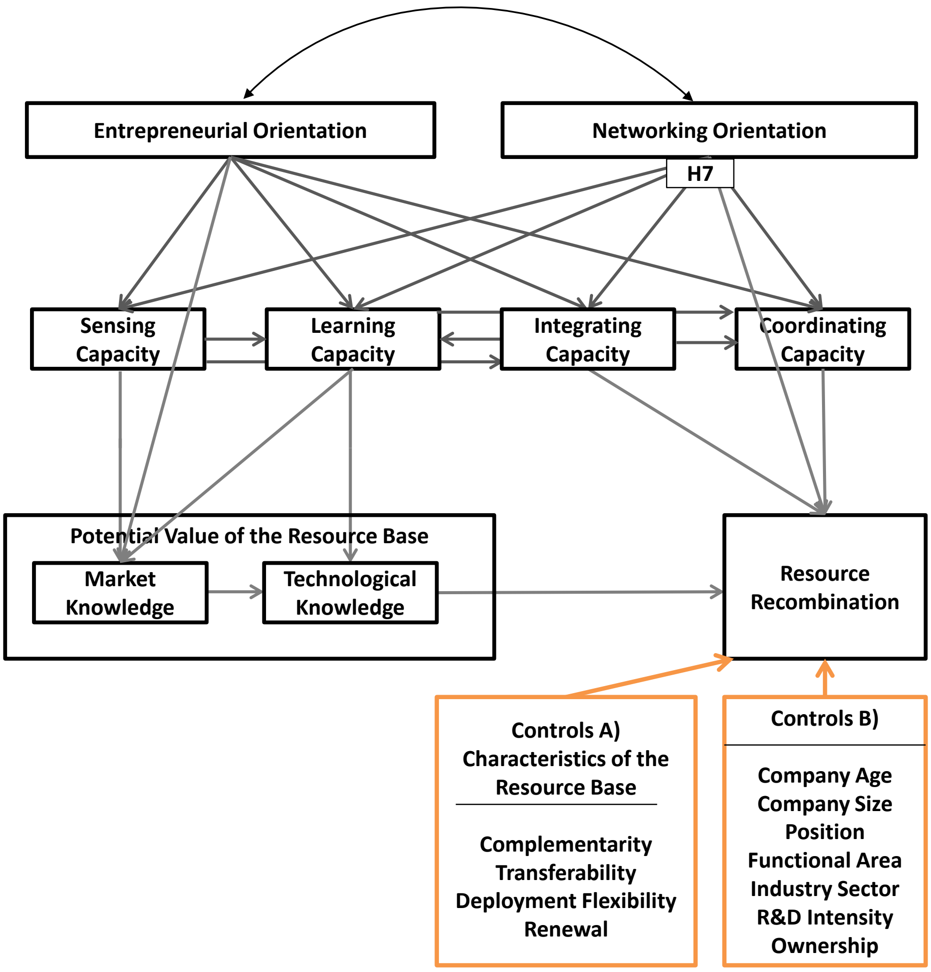
Likewise, **Entrepreneurial Orientation** showed an admittedly weaker, yet significant direct link to Sensing (ß=0.162), Learning (ß=0.163) and Integrating capacity (ß=0.142), supporting H6a, H6b, H6c. Also no support was established for the direct paths between Entrepreneurial Orientation and Coordinating capacity (p>0.005), rejecting H6d.

Hence, while neither Entrepreneurial Orientation nor Networking Orientation directly affect Coordinating capacity, interestingly the data revealed that for both, Networking Orientation and Entrepreneurial Orientation an indirect effect exists through the other DCs. As the above findings can only give indications on the type and significance level of the indirect effect, a more detailed analysis will additionally be provided in chapter 6.6.

Hypotheses relating to the potential Effect of specific Control Variables on RR

Two different groups of control variables were included in the analysis to reduce the possibility of alternate explanations. As illustrated in Figure 6.5 first the first group of controls looks at the potential effect of **specific characteristics of the resource base on RR**, while the second group includes **company and business related variables** and controls for their effect on RR.

Figure 6.5 Control Variables tested in the Model



Controls A: Specific Characteristics of the Resources Base

Proposition 1: The <u>potential value of the resource base</u> for RR is proposed to be influenced by certain characteristics of the resources.

H1a *(Resource Complementarity): Complementary Market and Technological Knowledge is positively related to RR in firms.*

H1b *(Resource Transferability): Tacit knowledge is negatively related to RR.*

H1c *(Resource Deployment Flexibility): Context-specific knowledge is negatively related to RR.*

H1d *(Resource Renewal): New, external knowledge is positively related to RR.*

As part of the analysis it was controlled for a potential effect of **specific characteristics of the resource base** on RR, as proposed in chapter 3.3. Prior to the structural path model a regression analysis was conducted, where the results showed, that no significant correlations between *Knowledge Tacitness, Knowledge Context Specificy, Knowledge Origin* and RR were established in this study. The only significant correlation emerged between *Knowledge Complementarity* and RR ($p<.05$).

Similar results were shown when including the controls in the structural path model, where no significant direct effects emerged between Knowledge Tacitness, Knowledge Specificy, Knowledge Origin and RR, and moreover also Knowledge Complementarity did not show to have a significant effect on RR, as the results presented in Table 6.8 show. The results hence lead to a rejection of H1a, H1b, H1c, H1d, implying that regardless of its characteristics – in terms of knowledge complementarity, tacitness, context specificy, origin – an increase in Market and Technological Knowledge significantly increases RR in firms.

Table 6.8 Standardised Effects, Critical Ratios and Hypotheses Tests

Hyp.	Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	Techno. Knowledge	RR	0.182	0.000	0.182	2.877**	YES
H4	Integrating Capacity	RR	0.264	0.155	0.419	3.863***	YES
H5	Coordinating Capacity	RR	0.241	0.000	0.241	3.089**	YES
Add	Networking Orientation	RR	0.226	0.248	0.474	3.940***	YES
H1a	Knowl. Complementarity	RR	0.032	0.000	0.032	0.658 (ns)	NO
H1b	Knowl. Tacitness	RR	- 0.027	0.000	- 0.027	0.584 (ns)	NO
H1c	Knowl. Specificy	RR	0.080	0.000	0.080	0.140 (ns)	NO
H1d	Knowl. Origin	RR	- 0.042	0.000	- 0.042	0.390 (ns)	NO

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level

Controls B: Company and Business Related Control Variables

Additionally a number of **company and business related variables** were included in the analysis to test for confounding variables. Confounding variables are variables that do not drive theory, however might have an influence on the outcome variables, and thus need to be controlled for (Gaskin, 2011). Thus it was controlled for a potential effect of *company size, company age, position* (whether the respondent was in the upper or middle management), *functional area* (whether the respondent yield a general management function or a specialist function), and *industry sector* (whether the company was acting industry or service sector), and *R&D intensity* on RR. The results presented in Table 6.9 show that none of the control variables emerged significant, thus this research findings are stable also when controls were included. Said differently, regardless of company size, age, position, functional area, industry sector and R&D intensity findings revealed that DCs and the Market and Technology Knowledge have a positive effect on RR in firms.

Table 6.9 Standardised Effects, Critical Ratios and Hypotheses Tests

Hyp.	Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	Techno. Knowledge	RR	0.184	0.000	0.184	3.021**	YES
H4	Integrating Capacity	RR	0.250	0.174	0.324	3.645***	YES
H5	Coordinating Capacity	RR	0.272	0.000	0.272	3.000***	YES
Add	Networking Orientation	RR	0.245	0.258	0.503	4.346***	YES
Control	Company Size	RR	0.036	0.000	0.036	0.701(ns)	NO
Control	Company Age	RR	- 0.059	0.000	- 0.059	-1.167(ns)	NO
Control	Position	RR	- 0.23	0.000	- 0.23	-0.437(ns)	NO
Control	Functional Area	RR	- 0.62	0.000	- 0.62	-1.274(ns)	NO
Control	Industry Sector	RR	0.034	0.000	0.034	0.691(ns)	NO
Control	R&D Intensity	RR	- 0.037	0.000	- 0.037	-0.726(ns)	NO

*** $p<0.001$; ** $p<0.01$; * $p<0.05$; Results are based on Bootstrap = 500; 95% confidence level

Having tested the potential effect of specific control variables on RR, the following sections further elaborate on research findings, showing support, or lack thereof, for individual **hypotheses regarding the role of DCs in the process of resource value creation**. The proposed mediating role the resource base has in the relationship between Sensing (H2a, H2b, and H2c) and Learning (H3a, H3b, H3c) and RR will be further tested in the section **mediation analysis**. While the moderating role of Integrating (H4a) and Coordinating capacity (H5a) in the relationship between Technological Knowledge and RR will be in the core of section 6.7 **moderation analysis**.

6.6 Mediation Analysis

This section outlines the results of the mediations analysis applied to further test the hypotheses relating to the mediating role of the resource base between Sensing and Leaning capacity and RR. **Mediation analysis** is used to describe a causal chain X→M→Y in order to provide a more precise explanation for the effect the independent variable (X) has on the dependent variable (Y), as transmitted through a mediation variable (M). Hence, by including a mediator "mediational models advance an X→M→Y causal sequence, and seek to illustrate the mechanisms through which X and Y are related" (Mathieu and Taylor, 2006, p. 1032) and thus help to explain more of the observed behaviour in the sample (Gaskin, 2012d).

Figure 6.6 Types of Mediation – Statistical Diagram

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Source: adapted from Gaskin (2012d), Hair et al. (2010), and Hayes (2013)

Three different types of mediation exist: (1) *indirect effect*[22], (2) *partial mediation*[23] and (3) *full mediation*[24] and, as illustrated in Figure 6.6.

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[22] An **indirect effect** implies that the independent variable (X) has a direct effect on the mediator (M), and the mediator has a direct effect on the dependent variable (Y), while at the same time there is no significant direct effect from X to Y. Thus X is said to have an indirect effect on Y. This hypothesis, however, can only be supported if the direct effect from X on Y is insignificant when the mediator is not included in the model, prior testing for an indirect effect (when the mediator is included) (Mathieu and Taylor, 2006).

[23] **Partial mediation** refers to the situation when both the direct and indirect effects from the independent variable (X) to the dependent variable (Y) are significant. This means that the unmediated X→Y relationship is significant, as well as the X→M and M→Y relationship. In order to avoid concluding that the partially mediating effect is significant, when in fact only the three independent partial effects are individually significant a significance test for mediation must be performed. Statistically speaking, in simple partial mediation βmx is the

Hypotheses relating to the Mediating Role of the Resource Base between Sensing and Leaning Capacity and RR

As formulated in **H2** and **H3** and already indicated by the preliminary results from the structural path analysis presented in the previous section the results confirm that a high Sensing and Learning capacity leads to an increased performance in regard to RR. However, as not all firms that have developed high DCs are subsequently high performing in achieving RR, this relation was expected to be fully and positively mediated by Market and Technological Knowledge, thus leading to a more precise formulation H2 and H3 through the following hypotheses:

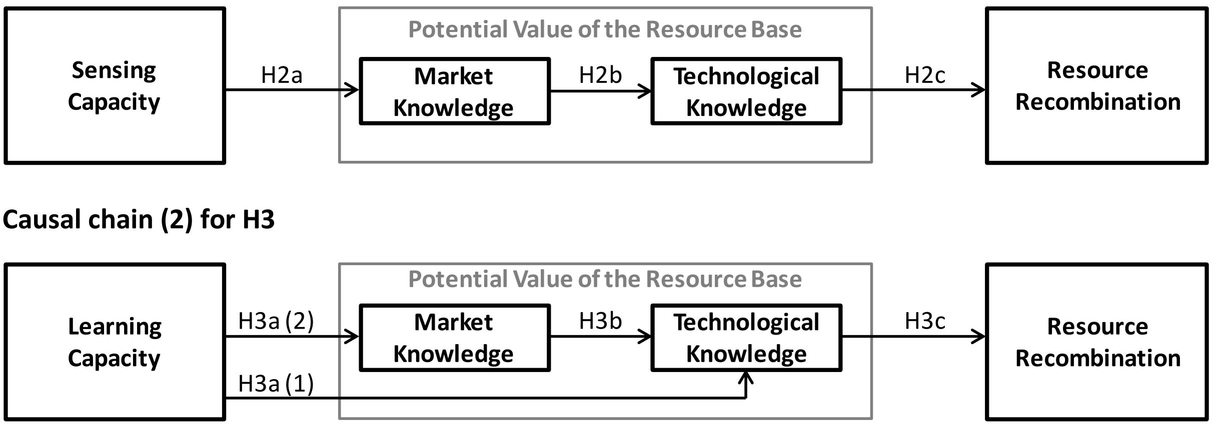
H2a/H2b/H2c: *The effect of Sensing capacity on RR* <u>*is positively and fully mediated*</u> *by Market and Technology Knowledge.*

H3a/H3b/H3c: *The effect of Learning capacity on RR* <u>*is positively and fully mediated*</u> *by Market and Technology Knowledge*.

Figure 6.7 Mediation Analysis – Causal Chains

Causal chain (1) for H2

Causal chain (2) for H3



Source: own illustration

The causal sequences as graphically presented in Figure 6.7, are tested in the following using mediation analysis. Mediation analysis usually "requires researchers to make a priori hypotheses concerning full or partial mediation and transforms confirmatory tests to exploratory data mining"

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path coefficient for X predicting M, and βym.x and βyx.m are the path coefficients for M, respectively X predicting Y. The latter (βyx.m) accounts the direct effect of X on Y, while the product βmx*βym.x describes the indirect effect X has on Y through M. Hence, if all variables are observed then the total effect βyx equals βyx.m + βmx*βym.x (Lyytinen and Gaskin, 2011, Mathieu and Taylor, 2006).

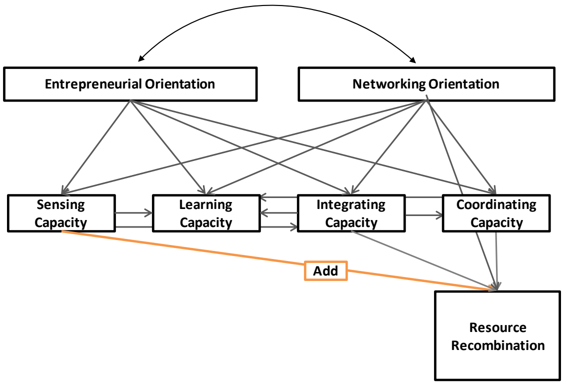
[24] **Full mediation** means that the direct effect of X on Y is only significant if the mediator is absent. When the mediator is present this direct effect becomes insignificant, while the indirect effect remains significant. Statistically, full mediation requires that βyx.m to be close to zero. In case βyx.m does not drop close to zero and remains significant when the mediator is included, evidence is given for partial mediation instead. Notably, likewise partial mediation also for full mediation both path βmx and βym.x have to be significant, otherwise if the X→M or M→Y relationship prove to be insignificant no mediation is existent (Lyytinen and Gaskin, 2011, Mathieu and Taylor, 2006).

(Lyytinen and Gaskin, 2011, p.24). To test the causal chains as described above a two step approach was conducted.

Figure 6.8 Mediation Analysis – Models with and without Mediation

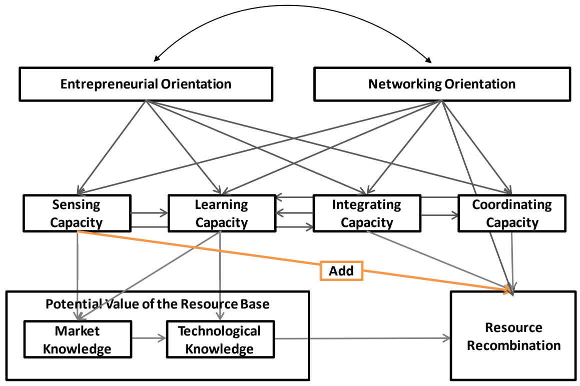
Step 1: Models without Mediators

Model A1 – Sensing capacity

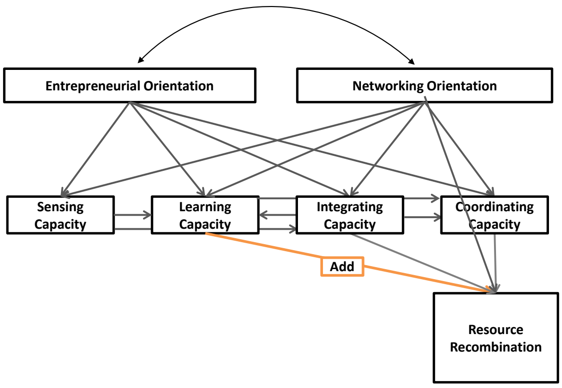


Step 2: Models with Mediators

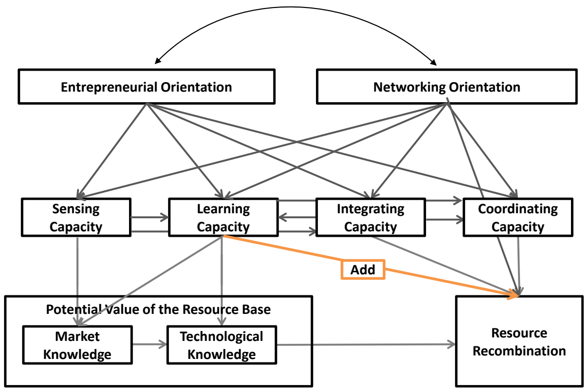
Model B1 – Sensing capacity



Model A2 – Learning capacity



Model B2 – Learning capacity



In a first step the structural path model was tested *without* mediators in AMOS as presented in Figure 6.8, where a direct path was drawn from Sensing capacity to RR (refer to model A1), respectively from Learning capacity to RR (refer to model A2), with everything else ceteris paribus. That means, the indirect path from the independent variable to the dependent variable through the mediating variables was deleted, while instead a direct effect was established.

In a second step the mediating variables were again included in the model (refer to model B1 for Sensing capacity, and model B2 for Learning capacity, respectively). Finally, comparing the direct effect models *without* mediation A1 (resp. A2) and the model *with* mediation B1 (resp. B2) a change in path coefficients gives evidence whether the proposed mediation effect is existent and what type of mediation is observed. The results are presented in Table 6.10.

Table 6.10 Results of the Mediation Analysis: Sensing and Learning Capacity on RR

Hyp	Causal Chain	Model without Mediators (A)	Model with Mediators (B)		Mediation type observed	Sup-port
		Direct βyx w/o med (p-values)	Direct βyx.m w/ med (p-values)	Indirect βmx* βym.x w/med (p-values)		
H2a H2b H2c	(1) Sens → Mknowl → Tknowl→RR	.126* (.030)	.106 (.066 - ns)	.012*(.028)	**full mediation**, with moderate and signifi-cant indirect effect	YES
H3a H3b H3c	(2) Learn → Mknowl → Tknowl→RR	.186** (.006)	.123 (.087 - ns)	.101**(.002)	**full mediation**, with strong and significant indirect effect	YES

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level

As the results presented in Table 6.10 show, an initial significant direct effect for Sensing on RR ($p<0.05$) and Learning on RR ($p<0.01$) could be established for both causal chains (1) and (2), which is a necessary precondition for a mediation effect being in place (Lyytinen and Gaskin, 2011). Furthermore, as shown in the fourth column this direct effect (between Sensing capacity and RR, as well as Learning capacity and RR) does not remain significant when the mediator was included in the model, which implies full mediation following Baron and Kenny (1986). According to Barron and Kenney (1986), the reason for the reduction in the path coefficients is due to the mediating variable, explaining some of the variance in the dependent variable that had previously been explained by the dependent variables but is more appropriately being explained through the mediator.

However, in order to determine and prove the significance of the suggested mediated relationship, it is suggested by several authors to further examine the significance of the indirect effects by using the bootstrapping technique (Preacher and Hayes, 2004, Gaskin 2011d). Looking at the two-tailed significance levels for the standardised indirect effects as presented in column 5, both indirect effects were significant ($p<0.05$ for Sensing on RR, $p<0.01$ for Learning on RR, respectively) with the bias-corrected confidence interval set up to 0.95 and a bootstrap with m = 500. The results give statistical support to H2a/H2b/H2c and H3a/H3b/H3c, that Market and Technological Knowledge fully mediate the effect of Sensing and Learning capacity on RR in firms ($p<0.05$).

H1(1): *Market Knowledge has an indirect, positive effect on RR, through Technological Knowledge.*

Additionally, while being integral part of the causal sequence as described above, a more detailed investigation of the causal relationship between Market Knowledge, Technological Knowledge and RR was deemed valuable. The results as presented in Table 6.11, confirm that Market Knowledge only indirectly affects RR, through Technological Knowledge, as both direct effects are not significant, but the indirect effect is significant (p<0.01). Hence, additional support is given to H1(1) that Market Knowledge has an indirect, positive effect on RR, through Technological Knowledge.

Table 6.11 Results of the mediation analysis: Market Knowledge on RR

Hyp	**Causal Chain**	**Model without Mediators (A)**	**Model with Mediators (B)**		**Mediation type observed**	**Sup-port**
		Direct Beta w/o med (p-values)	**Direct Beta w/ med (p-values)**	**Indirect Beta (p-values)**		
H1(1)	(3) Mknowl → Tknowl →RR	.070 (.195-ns)	-.003 (.954- ns)	.074** (.007)	**indirect effect** (no mediation), as both direct effects are in-significant, but indirect effect is significant	YES

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level

Beside it was deemed valuable to further analyse the **mediating role that DCs** have in the relationship between EO, respectively NO, and RR. As already indicated by the results presented in chapter 6.5.5, support was given to H6a, H6b, H6c and H7a, H7b, H7c, confirming that both EO and NO positively influence the development of Sensing, Learning and Integrating capacities. On the other hand, no significant direct association emerged between EO (NO, respectively) and Coordinating capacity, leading to a rejection of H6d (and H7d). To further elaborate on these findings, it was deemed valuable to investigate the relation EO and NO have on RR though the DCs in more detail, specifying the direct and indirect relations, and in case mediation is in place, what type of mediation (full or partial). The results are presented in Appendix 6.7.

6.7 Moderation Analysis

This section outlines the results of the moderation analysis to further test the hypotheses relating to the moderating role of Integrating and Coordinating capacity between the resource base and RR. Moderation analysis is used as a method to provide a more precise explanation of a causal relationship between a dependent variable (X) and an independent variable (Y), as it considers "not only how X effects Y, but also under what circumstances the effect of X changes depending on the moderating variable (W)" (Gaskin, 2002d). To illustrate this causal effect, the conceptual model for moderation is presented in Figure 6.9. According to Preacher et al. (2007), moderation also referred to as conditional effect, is present "when the strength of the relationship between two variables is dependent on a third [moderating] variable" (Preacher et al., 2007, p.191). Similarly to mediation, moderation analysis enables a more precise investigation of the causal effects between two variables and helps explaining more of the observed behavior in the sample. Moderating variables must be chosen with strong theoretical support (Hair et al., 2010).

Figure 6.9 Conceptual Diagram of the Moderation Effect

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Source: adapted from Gaskin (2012d) and Hayes (2013)

Hypotheses relating to the Moderating Role of Integrating and Coordinating capacity between Resource Base and RR

H4a: *A high Integrating capacity is positively associated with RR in firms as it is moderating the relationship between Technological Knowledge and RR in firms.*

H5a: *A high Coordinating capacity is positively associated with RR in firms as it is moderating the relationship between Technological Knowledge and RR in firms.*

As formulated in **H4a** and **H5a** it was to be expected that Integrating and Coordinating capacity of the firm moderate the relation between the resource base and RR. The results from the path analysis in chapter 6.5.5 already confirmed the positive relation between Technological Knowledge and RR, the following section sets out to test if this relation is moderated by Integrating and Coordinating capacity. Hence it is suggested that a high Integrating and Coordinating capacity (W) is positively associated with RR in firms as it is moderating the relationship between the resource base (X) and RR

(Y) in firms[25]. The following chapter aims to test these causal relations as describes above using a moderation analysis technique.

Kenny und Judd (1984) have presented a method for statistical assessment of moderation effects which explicitly considers latent moderation variables through the calculation of a manifest product variable (Reinecke, 1999). Based on Kenny and Judd`s (1984) considerations a moderation effect is typically addressed with the regression equation: (3) $Y = \alpha + \beta_{yx}X + \beta_{yw}W + \beta_{yxw}XW + \zeta$; whereby X represents the independent and Y the dependent variable, W is considered as the moderator, and XW represents the interaction variable formed by the product of W and X. Furthermore α represents the vectors for the intercept term, while the regression weights β describe the main direct effects βyx between X and Y, βyw between W and Y, and βyxw between XW and Y, respectively. ζ represents the residual (or error term) of Y. Hence the moderator M interacts with X in predicting Y, as the regression weight of X on Y (βyx) varies as a function of W. Basically the regression equation specifies that the slope of the regression weight relating X to Y changes at different levels of W (Preacher et al., 2007, Reinecke, 1999). The graphical notation of the model by Kenny and Judd is presented in Figure 6.10.

Figure 6.10 Statistical Diagram of the Moderation Effect

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Source: adapted from and Hayes (2013)

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[25] Given the suggested causal chain in this research`s model, more correctly it is to speak about **moderated mediation.** As described by Preacher et al. (2007), moderated mediation is given "when the strength of an indirect effect depends on the level of some variable, or in other words, when mediation relations are contingent on the level of a moderator" (Preacher et al., 2007, p.193). In other words, the strength of an indirect or mediation effect may depend linearly upon the value of the moderation variable. Therefore, in the literature moderated mediation is also referred to as conditional indirect effect (Preacher et al., 2007). As for this research model, the mediation effect of Market/ Technological Knowledge on the relation between Sensing/Learning and RR (as presented in the previous chapter) might only occur for those firms having high Integrating or Coordinating capacities, but not for firms having low Integrating and Coordinating capacities. Hence, moderated mediation models enable a more precise explanation of 'how' and 'when' a suggested indirect effect occurs (Preacher et al., 2007). In this regard, it is of interest whether or not a suggested mediating effect remains constant across different contexts, groups or values of the moderating variable (Gaskin, 2011d). It is expected that the effect of Sensing and Leaning on RR is mediated by Market and Technological Knowledge, and moreover that this mediation differs across firms with high and low Integrating and Coordinating capacities. Preacher et al. (2007) claim that moderated mediation can take many forms, for some of which they provide examples. This research concentrates on the type of moderated mediation illustrated in model 3 presented by Preacher et al. (2007).

For testing moderation models, generally two categorical different methods exist: (1) **Multi-group moderation analysis**, e.g. using Chi-square difference test or Critical Ratios for differences test and (2) **Interaction effect methods,** e.g. using SEM techniques with interaction terms or traditional non SEM-methods for interaction effects.

Main differences between the two methods are that while *multi-group moderation analysis* generally use categorical variables, whereby the dataset is split into two categorical different groups and paths are constrained across groups, the *interaction effect method* uses continuous variables, applies the whole dataset, and integrates an interaction variables (the product term X*W, as illustrated in Figure 6.10 above) (Gaskin, 2011d). In spite of these elementary differences, the literature makes little distinction between multi-group and interaction effect methods. One reason might be due to the fact that also in interaction effect models continuous interaction effect variables are often approached as categorical variables, similar to those used for multi-group analysis[26] (e.g. Preacher et al., 2007), which in consequence leads to a similar interpretation of results although different methods were applied (Gaskin, 2011d).

To encounter the indifference in use, and thereby to enable a comparison of each methods` results while at the same time making use of each method`s merits, both methods are applied for this research, whereby categorical variables are used both for the multi-group analysis, and categorical variables are used for the interaction effect method. Correspondingly, in a first step *multi-group analysis* will be applied in the following section in order to provide evidence whether the underlying measurement models are valid and whether meaningful and statistical significant interaction effects are likely to be expected (Reinecke, 1999). In a second step the *interaction effect method* will be applied in chapter 6.7.2 for calculating the path coefficient of the interaction term and thus getting indiations about the actual strength of the moderation effect (Preacher et al., 2007).

6.7.1 Multi-Group Moderation Analysis

A multi-group moderation analysis was deemed valuable to test whether high or low levels of Coordinating and Integrating capacities have different effects on the relation between Technological Knowledge and the outcome variable RR. Multi-group moderation analysis is a specific form of moderation, whereby the given dataset is grouped along values of a categorical variable, and in a subsequent step the model is separately tested among these two groups in order to determine whether the suggested relationships in the model are contingent on the value of the moderator (Gaskin, 2011d).

[26] Preacher et al. (2007) themselves, while makings use of interaction effect methods, ended up treating their continuous interaction variables as categorical variables at the end.

In order to test the variance in the regression coefficient (βyx) for the different groups, the data set was split using the variables Integrating and Coordinating capacity into two separate groups for each variable. Through mediatisation of the indices by means of calculating the grouping variable`s mean +/- 0.5 standard deviations (sd), two categorical different groups were built, one containing those firms with high Integrating capacities (values between 5.961 – 7), respectively high Coordinating capacity (values between 5.823 – 7), and the other comprising those firms with low Integrating capacity (values between 0 – 4.673), respectively Coordinating capacity (values between 0 – 4.629).

Table 6.12 Mean, Standard Deviation and N for the Grouping Variables

Grouping Variable	mean	sd	mean + ½ sd	mean – ½ sd	N	
					High	Low
Integrating capacity	5.317	1.288	5.961	4.673	85	63
Coordinating capacity	5.226	1.194	5.823	4.629	72	61

In order to test for statistical differences among those groups, two multi-group analysis per construct were performed, where the relationship between Technological Knowledge and RR was once tested for the group with high and simultaneously for the group with low Integrating capacity. Thereafter the same procedure was adapted for the two groups "high Coordinating capacity" vs. "low Coordinating capacity".

For testing multi-group moderation the regression equation (3) as presented above, usually is transformed as follows:

(4) $Y = (\alpha + \beta_{yw}W) + (\beta_{yx} + \beta_{yxw}W) * X + \zeta$

Equation 4 shows the regression of the independent construct Technological Knowledge (X) on RR (Y) as a function of Integrating resp. Coordinating capacity (W). In case interaction effects exist, βyxw is higher than βyx for those firms with a value for W above the mean plus 0.5 sd, and lower for those firms with values for W below the mean minus 0.5 sd (Reinecke 1999).

Two statistical methods for the analysis of mediation effects my means of multiple-group analysis exists: (1) a (stepwise) Chi-square difference test or (2) a Critical Ratio for differences test, both methods leading to similar results in order to determine whether meaningful significant interaction effects exist (Gaskin, 2011d). To test the proposed effect, both methods were applied in this research resulting in comparable results. While the method and results of the Chi-Square-Difference test is described in detail below, the results of the Critical Ratio for differences test can be found in the Appendix 6.8.

A **chi-square difference test** was used to determine, if the difference in the strength and direction of the regression weights between the two groups is actually significant. A $\Delta\chi^2$-test was conducted simultaneously for the two groups, following the three step standard procedure, as detailed in Appendix 6.4, including the estimation of (1) the unconstrained multi-group model, (2) the constrained multi-group model, and (3) the comparison of the difference of $\Delta\chi^2$ and Δdf between the constrained and unconstrained model. The results are provided in Table 6.13 for those firms with high and low Integrating capacity (Model A). Table 6.14 provides the corresponding results for firms with high and low Coordinating capacity (Model B).

Table 6.13 Δχ2Test – Model A: Integrating Capacity high and low

Model A: Integrating	χ^2	**df**	$\Delta\chi^2$	**Δdf**	**P**
unconstrained model	60.266	30	-		
fully constrained model	96.14	50	35.943	20	**0.016**

Table 6.14 Δχ2Test – Model B: Coordinating Capacity high and low

Model B: Coordinating	χ^2	**Df**	$\Delta\chi^2$	**Δdf**	**P**
unconstrained model	48	30	-		
fully constrained model	88.822	50	40.822	20	**0.004**

The result shows that the $\Delta\chi^2$ is significant at the 0.05 level, when comparing firms with high vs. low Integrating capacity. In a similar vein, significant differences ($p>0.01$) could be established at the model level when comparing firms with high vs. low Coordinating capacity. The results lead to the conclusion that not all regression weights are equal across groups (Kline, 2005), and that there are significant differences in strength and direction of the regression weights between the two groups.

Given these results, a stepwise estimation of the model was deemed valuable for a more detailed investigation of which specific paths are different across groups. This is done by constraining one path at a time and comparing the χ^2 of the (path-wise) constrained model with the χ^2 of the unconstrained model (Plewa, 2010). The results of the path by path model estimation are presented in Table 6.15 for Integrating capacity, and in Table 6.16 for Coordinating capacity high vs. low, respectively.

Table 6.15 Stepwise Δχ2Test – Model A: Integrating Capacity high and low

Model A: Integrating Capacity	**χ^2**	**df**	**$\Delta\chi^2$**	**Δdf**	**P**
unconstrained model	60.266	30	-		
constrained path: EO --> Sensing	61.727	31	1.461	1	0.227
constrained path: EO --> Learning	60.33	31	0.064	1	0.800
constrained path: EO --> Integrating	60.803	31	0.537	1	0.464
constrained path: NO --> Sensing	61.18	31	0.914	1	0.339
constrained path: NO --> Learning	60.377	31	0.111	1	0.739
constrained path: NO --> Integrating	62.371	31	2.105	1	0.147
constrained path: Sensing --> Market Knowledge	60.494	31	0.228	1	0.633
constrained path: Learning --> Market Knowledge	61.074	31	0.808	1	0.369
constrained path: Market Knowledge--> TechnoKnowl	60.642	31	0.376	1	0.540
constrained path: Learning --> Technological Knowledge	60.538	31	0.272	1	0.602
constrained path: Technological Knowledge --> RR	**63.664**	31	3.398	1	**0.065**
constrained path: Integrating --> RR	60.524	31	0.258	1	0.611
constrained path: Coordinating --> RR	**64.04**	31	3.774	1	**0.052**
constrained path: EO --> Market Knowledge	60.817	31	0.551	1	0.458
constrained path: NO --> RR	60.503	31	0.237	1	0.626

A χ^2 above the threshold of 62.97 (90% confidence), 64.11 (95% confidence) or 66.90 (99% confidence) indicates variance at the specific path.

Table 6.16 Stepwise Δχ2Test – Model B: Coordinating high and low

Model B: Coordinating Capacity	**χ^2**	**df**	**$\Delta\chi^2$**	**Δdf**	**P**
unconstrained model	48	30	-		
constrained path: EO --> Sensing	48.911	31	0.911	1	0.340
constrained path: EO --> Learning	48.201	31	0.201	1	0.654
constrained path: EO --> Integrating	50.538	31	2.538	1	0.111
constrained path: NO --> Sensing	48.963	31	0.963	1	0.326
constrained path: NO --> Learning	48.35	31	0.35	1	0.554
constrained path: NO --> Integrating	48.55	31	0.55	1	0.458
constrained path: Sensing --> Market Knowledge	49.618	31	1.618	1	0.203
constrained path: Learning --> Market Knowledge	48.241	31	0.241	1	0.623
constrained path: Market Knowledge--> TechnoKnowl	49.247	31	1.247	1	0.264
constrained path: Learning --> Technological Knowledge	50.144	31	2.144	1	0.143
constrained path: Technological Knowledge --> RR	**50.905**	31	2.905	1	**0.088**
constrained path: Integrating --> RR	**53.922**	31	5.922	1	**0.015**
constrained path: Coordinating --> RR	48.207	31	0.207	1	0.649
constrained path: EO--> Market Knowledge	48.206	31	0.206	1	0.650
constrained path: NO --> RR	48.201	31	0.201	1	0.654

A χ^2 above the threshold of 50.91 (90% confidence), 52.04 (95% confidence) or 54.84 (99% confidence) indicates variance at the specific path.

Two sources of variance on the path level were identified in each model A (Integrating) and model B (Coordinating). The results confirm a moderating role of Integrating and Coordinating capacity as the path between Technological Knowledge and RR ($p<0.10$) showed a significant $\Delta\chi^2$ in both models meaning that this path is different across groups. The difference in the regression weights between the two groups indicates a non-linear relations between Technological Knowledge and RR (Reinecke, 1999). Furthermore, the path between Coordinating capacity and RR ($p<0.10$) and the path between Integrating capacity and RR ($p<0.05$) also showed a significant $\Delta\chi^2$ in the respective model[27].

Thus, it can be said with 90% confidence that Integrating and Coordinating capacity, both moderate the relationship between Technological Knowledge and RR, as for the two groups both these relationships are significantly different across groups. Furthermore, the finding suggests that while Integrating capacity moderates the path between Coordinating capacity and RR at a 90% confidence level, Coordinating capacity moderates the path between Integrating capacity and RR at a 95% confidence level. At the same time, all other paths are invariant across groups, meaning that invariance is established at the paths level for all other relationships. As mentioned before, similar results could be found by means of the Critical Ratio for difference test, the results can be found in Appendix 6.8.

Given that there is variance established at the path-level, to further elaborate the differences across groups for the specific paths identified above, a more detailed investigation of the direction and strength of variance are worthwhile. Therefore in a last step the model was calculated separately for each of the groups (Integrating high, Integrating low, Coordinating high, Coordinating low) and the respective regression weights (β) for the non invariant paths were compared (Plewa, 2010). The findings are presented in Table 6.17. However, considering the small sample size of the single groups (refer to Table 6.12), the statistical power of the results should be treated with caution (Diamantopoulos and Siguaw, 2000) unless the findings are being confirmed by an independent, preferably larger sample (Plewa, 2010).

Table 6.17 Comparison of Regression Weights – Integrating Capacity high and low

Paths	Integrating_low		Integrating_high		Coordinating_low		Coordinating_high	
	Stand. Regr. weights	P	Stand. Regr. weights	P	Stand. Regr. weights	P	Stand. Regr. weights	P
TechnoKnowl --> RR	0.139	0.275	0.364	0.001	0.204	0.091	0.327	0.000
Coordinating --> RR	0.228	0.091	0.380	0.000	--	--	--	--
Integrating--> RR	--	--	--	--	0.163	0.224	0.466	0.000

[27] The Chi-square difference test usually regards the 90% confidence level for significant differences; therefore also p-values < 0.10 are regarded as significant for this kind of analyses (Gaskin, 2012d).

The coefficients show that for firms with high Integrating and Coordinating capacity the relationship between Technological Knowledge und RR is stronger than for firms with low Integrating and Coordinating capacity. More specifically, the differences in the regression weights indicate that the positive influence Technological Knowledge has on RR is 2.6 times as strong when Integration is high (β_{lowI}= 0.139 vs. β_{highI} = 0.364) and 1.6 times as strong when Coordination is high (β_{lowC}= 0.204 vs. β_{highC} = 0.327). With respect to p-values, Technological Knowledge only influenced RR significantly when high Integrating and Coordinating capacity is established in firms. In both cases the relation between Technological Knowledge and RR became insignificant ($p>0.05$) when Integrating and Coordinating capacity was low. In consequence, even if the Technological Knowledge a firm possesses is high, it does not affect RR in firms, if the firm does not possess a high capacity to integrate and coordinate that knowledge in order to achieve RR.

Results from the mediation analysis (see chapter 6.6) showed that Technological Knowledge mediates the relationship between Sensing/Learning capacity and RR. However the above findings indicate that this mediating effect is further moderated by the firm's level of Integrating and Coordinating capacity, in a way that Technological Knowledge mediates the relation between Sensing/ Learning capacity and RR only for those firms possessing a high Integrating and Coordinating capacity. This is when research also speaks about moderated mediation (for a similar investigation see Ng et al., 2008). Elaborating the moderated mediation effects, an analysis of the differences in size, direction and significance of the indirect (mediating) effects for each group were additionally conducted, the results are presented in Appendix 6.9.

In sum, to capture the conception of causal relations between the DCs, the Resource Base and RR more closely, a multi-group moderation analysis was conducted. The regression weights in the final structural path model were compared across groups and differentiated based on their levels of sophistication in firms and their intentions to recombine new resources. The results give statistical **support for H4a and H5a**, confirming that both Integrating and Coordinating capacity moderate the relationship between Market and Technological Knowledge and RR. Said differently, Integrating and Coordinating capacity is found to strengthen the positive relationship between Technological Knowledge and RR.

However, several restrictions exist for the multi-group moderation analysis. First, for the multiple-group comparison the applied grouping method (unweighted mediatisation of the indices) is rather chosen ad hoc, and thus a different grouping procedure for the same variables might lead to different results for the multi-group analysis (Reinecke, 1998). Second, multi-group analysis do not consider a random measurement error of the grouping variable (Reinecke, 1998). Third, in multi-group moderation analysis the strength and significance of the moderation (interaction) effect can only be investigated *indirectly* through the differences in parameters between the two groups. The calculation of the structural regression weight (βyxw in equation 4), which indicates the strength and significance of the effect the moderating variable has on the dependent latent variable, is not provided (Reinecke, 1998). The later restriction of the multi-group analysis is probably the most important argument for the construction of a latent interaction effect variable, whereby a value for βyxw can be estimated.

6.7.2 Interaction Effect Method

As the results of the multi-group analysis gave evidence that significant interaction effects exist, it was deemed valuable to analyse these interaction effects in a subsequently research step in regard to their strength by means of interaction effect method as provided in the following.

Although the approach by Kenny and Judd (1984) of modelling interaction as a simple product term by using all cross products as indicators of the latent variables, is widely used in research practice (e.g. Pavlou and El Sawy, 2011), there is still an ongoing debate on the appropriate modelling of interaction effects especially in the context of SEM (e.g. Van den Putte and Hoogstraaten, 1997). While most methodologists agree that the product term builds a 'proper quantification' of the interaction effect and hence is regarded as the most accurate statistical representation and method available (MacKinnon et al., 2004), up to today modelling moderated mediation is still a methodological dispute as "clear methods have not yet been articulated in the literature for investigating whether (and, if so, how) an indirect effect varies systematically as a function of another variable" (Preacher et al., 2007, p. 187). Preacher et al. (2007) made a first attempt towards overcoming this issue, however, they used only traditional non SEM-techniques to test for conditional indirect effects, while likewise stating that moderated mediation is best tested in SEM software like AMOS, where all paths can be tested simultaneously and continuous variables can be used. Subsequently, this research takes up the conceptual thoughts as presented by Preacher at al. (2007) by applying the interaction effect method in a more complex SEM context.

Thus, in this research the interaction effects of Integrating and Coordinating capacity were tested following Preacher at al. (2007, 2005), Ping (1995) and Van den Putte and Hoogstraaten (1997), whereby first all variables in the model were Z-transformed (standardised) in SPSS to avoid identification problems (Cortina et al., 2001). Secondly, a new interaction effect variable X*Y was computed by calculating X and Y: $X*Y = \sum X_i * \sum Y_i$, with the loadings of the interaction variable X*Y being $\lambda_{X,Y} = \sum\lambda_{Xi} * \sum\lambda_{Yi}$ (as proposed by Ping, 1995 and Pavlou and El Sawy, 2011), and thirdly the new interaction variable was included in the model in order to estimate the strength and significance of the regression weight βyxw (Gaskin, 2011d)[28].

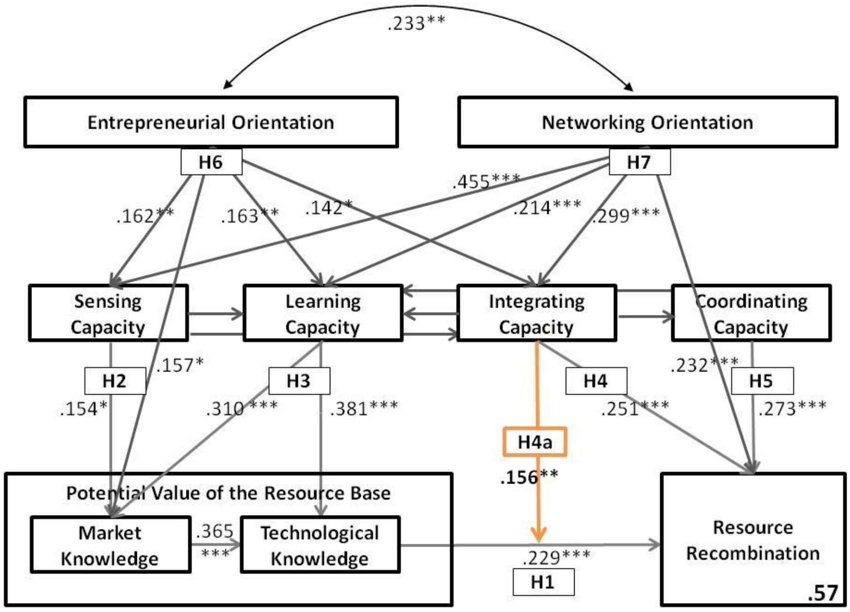
In a first estimation step, the models were calculated for each interaction variable separately. The results are presented in Figure 6.11 for Integrating capacity and in Figure 6.12 for Coordinating capacity. For both models a good model fit was achieved. All model fit indices for the **Interaction effect model A: Integrating capacity** indicated excellent fit with a χ^2/df (=1.756), GFI (=0.966), AGFI (=0.910), TLI (=0.960), CFI (=0.981) and NFI (=0.958), this was supported by a non-significant χ^2 ($p>0.05$) and an RMSEA value of 0.060 and RMR of 0.072. Similar good model fit results were obtained for the **Interaction effect model B: Coordinating capacity** with a non-significant χ^2/df (=1.937), GFI (=0.963), AGFI (=0.902), TLI (=0.950), CFI (=0.977), NFI (=0.954) and RMSEA (=0.067), all indicating to an excellent fit, solely the RMR (=0.094) was slightly above the acceptable threshold for this research. Given this good model fit, both models qualified for further hypotheses testing.

[28] The integration of interaction effect terms in SEM-based models involves the consideration of non-linear restrictions when building the model, which gives potential rise to constraints in regard to the model estimation procedure (Reineke, 1998): First, while the ML-method applied here generally suggests the assumption of multivariate normality (Reinecke, 1999), this condition is hurt when using product terms (even though the single measured constructs are normal distributed, their products are not). Irrespectivly, recent simulation studies could approve the ML-method to be relatively robust and stable against violation of the normal distribution as long as the sample size is higher than 200 (e.g. Hoogland and Boomsma, 1998). Second, although there is an ongoing debate on the appropriateness of the standard error of measurement for inferential statistical evaluations when using product variables (see Jonnson, 1997), the use of standard errors is commonly accepted among researchers also when applying non-linear components (Jaccard and Wan, 1996, Reineke, 1999). Third, when using product terms often the violation of multivariate normality leads to high χ^2 values, especially when applying the ML-method, where the statistical precondition are worst affected due to the use of product terms (Reineke, 1999).

Notably, aside from the deterioration of the model fit indices, a comparative study applying three different estimation methods (the ML, GLS and WLS method) revealed no substantial difference in the interpretation of the latent interaction models. Instead, the comparison of the estimates in terms of significance levels (p-value) and the strength of effects, lead to the same interpretations regarding the content for the three different procedures applied (see Reineke, 1999). For this reasoning, the use of interaction effects in the model was justified for the estimation process. Additionally, against expectations, an excellent model fit was achieved for all three models (as presented below), therefore the appropriateness of the applied interaction effect method was further ratified.

Morover, as an integration of each additional interaction effect leads to a growing number of non-linear restrictions (Reineke, 1998), this poses the risk of convergence problems during model estimation, as for example presented and discussed in Jonsson (1997) and Reineke (1999). Hence, to avoid convergence problems, this research abstained from including all potential mediation effects, instead only those moderation effects are included, that were theoretically considered before. For that reasoning the proposed moderation effect of Integrating capacity on Coordinating capacity → RR, and Coordinating capacity on Integrating capacity → RR, as indicated by the results of the multi-group moderation analysis, were not considered.

Figure 6.11 Interaction Effect Model A - Integrating Capacity

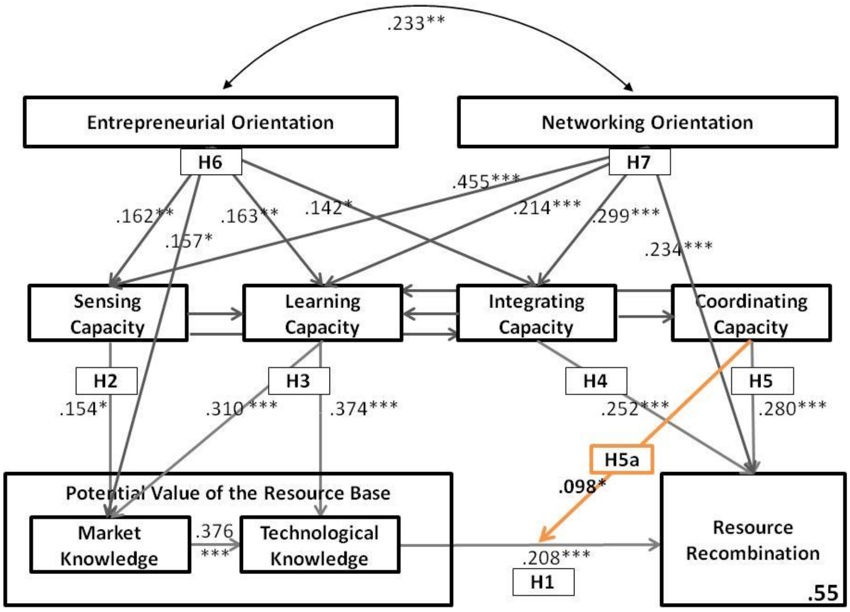


χ^2 Chi-Square value	36.873	Tucker-Lewis Index (TLI)	0.960
Degrees of freedom	21	Comparative Fit Index (CFI)	0.981
p value	0.168	Normed Fit Index (NFI)	0.958
χ^2/ df value	1.756	Root Mean-Square Error (RMSEA)	0.060
Goodness-of-Fit (GFI)	0.966	Root Mean Squared Residual (RMR)	0.072
Adjusted Goodness-of-Fit (AGFI)	0.910	Consistent Akaike Information Criterion (CAIC)	252.3

Hyp.	Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	Techno. Knowledge	RR	0.229	0.000	0.229	4.098***	YES
H2	Sensing capacity	RR	n.s	0.192	0.192	n.s	YES
H2a	Sensing capacity	Market Knowledge	0.154	0.127	0.281	2.056*	YES
H3	Learning capacity	RR	n.s	0.236	0.236	n.s	YES
H3a(1)	Learning capacity	TechnoKnowledge	0.381	0.113	0.494	6.454***	YES
H3a(2)	Learning capacity	Market Knowledge	0.310	0.000	0.310	4.000***	YES
H2b/3b	Market Knowledge	TechnoKnowledge	0.365	0.000	0.365	6.174***	YES
H4	Integrating capacity	RR	0.251	0.178	**0.429**	3.876***	YES
H4a	**Integr. X TechnoKnow**	**RR**	**0.156**	**0.000**	**0.156**	**3.269****	**YES**
H5	Coordinating capacity	RR	0.273	0.000	0.273	3.798***	YES
H6a	EO	Sensing capacity	0.162	0.000	0.162	2.653**	YES
H6b	EO	Learning capacity	0.163	0.098	0.261	3.081**	YES
H6c	EO	Integrating capa.	0.141	0.035	0.176	2.255*	YES
H7a	NO	Sensing capacity	0.455	0.000	0.455	7.430***	YES
H7b	NO	Learning capacity	0.214	0.245	0.459	3.545***	YES
H7c	NO	Integrating capa.	0.299	0.098	0.397	4.312***	YES
Add	NO	RR	0.232	0.266	0.498	4.375***	YES
Add	EO	Market Knowledge	0.157	0.105	0.262	2.429*	YES

*** p<0.001; ** p<0.01; *p<0.05; Results are based on Bootstrap = 500; 95% confidence level

Figure 6.12 Interaction Effect Model B - Coordinating Capacity



χ^2 Chi-Square value	40.678	Tucker-Lewis Index (TLI)	0.950
Degrees of freedom	21	Comparative Fit Index (CFI)	0.977
p value	0.108	Normed Fit Index (NFI)	0.954
χ^2/ df value	1.937	Root Mean-Square Error (RMSEA)	0.067
Goodness-of-Fit (GFI)	0.963	Root Mean Squared Residual (RMR)	0.094
Adjusted Goodness-of-Fit (AGFI)	0.902	Consistent Akaike Information Criterion (CAIC)	256.2

Hyp.	Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	Techno. Knowledge	RR	0.208	0.000	0.208	3.692***	YES
H2	Sensing capacity	RR	n.s	0.189	0.189	n.s	YES
H2a	Sensing capacity	Market Knowledge	0.154	0.127	0.281	2.056*	YES
H3	Learning capacity	RR	n.s	0.226	0.226	n.s	YES
H3a(1)	Learning capacity	Techno.Knowledge	0.374	0.117	0.491	6.202***	YES
H3a(2)	Learning capacity	Market Knowledge	0.310	0.000	0.310	4.000***	YES
H2b/3b	Market Knowledge	Techno.Knowledge	0.376	0.000	0.376	6.318***	YES
H4	Integrating capacity	RR	0.252	0.180	0.432	3.801***	YES
H5	Coordinating capacity	RR	0.280	0.000	0.280	3.839***	YES
H5a	**Coord. X TechnoKnow.**	**RR**	**0.098**	**0.000**	**0.098**	**1.990***	**YES**
H6a	EO	Sensing capacity	0.162	0.000	0.162	2.653**	YES
H6b	EO	Learning capacity	0.163	0.095	0.258	3.081**	YES
H6c	EO	Integrating capa.	0.142	0.036	0.178	2.278*	YES
H7a	NO	Sensing capacity	0.455	0.000	0.455	7.430***	YES
H7b	NO	Learning capacity	0.214	0.246	0.460	3.545***	YES
H7c	NO	Integrating capa.	0.299	0.100	0.399	4.319***	YES
Add	NO	RR	0.234	0.263	0.497	4.325***	YES
Add	EO	Market Knowledge	0.157	0.105	0.262	2.429*	YES

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level

H4a: *A high Integrating Capacity is positively associated with RR in firms as it is moderating the relationship between Technological Knowledge and RR in firms.*

The results presented in Figure 6.11 indicate a strong and positive influence of the interaction effect variable on RR, significant at a 0.01 level. The value of the structural regression weight (βyxw) shows a significant direct effect of 0.156 the moderating variable Integrating capacity has on the relation between Technological Knowledge and RR. This positive association gives support to H4a and confirms the moderating role of Integrating capacity as a key driver for resource value creation in firms, supporting hypothesis H4a. Besides, its already established strong and positive direct effect of 0.251 on RR in firms, with a total effect rising to 0.429, Integrating capacity thus was additionally proven to enhancing the relation between the resources available in firms and their recombinations.

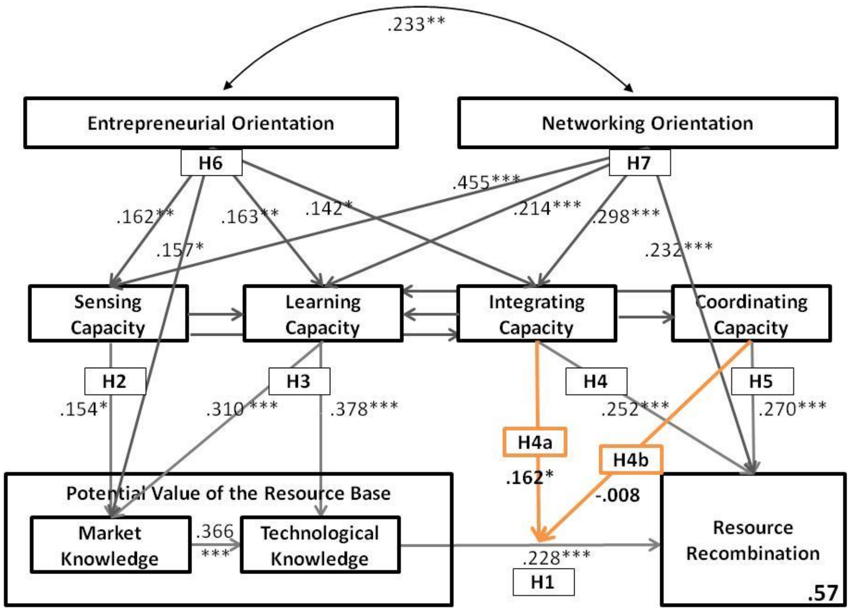
H5a: *A high Coordinating Capacity is positively associated with RR in firms as it is moderating the relationship between Technological Knowledge and RR in firms.*

Support was also found for hypothesis 5a, as the results shown in Figure 6.12 confirm a significant positive impact of the interaction variable (Integrating*Technological Knowledge) on RR. In relation to Integrating capacity a relatively weak interaction effect of 0.098 was established, however the effect was still found to be significant at a 0.05 level. Notably, while the moderating role of Coordinating capacity could be confirmed, it does not show to be as strong as for Integrating capacity. This result is somewhat surprising, given the strong direct effect of 0.280 from Coordinating capacity to RR.

Following the call for a proper integration of the interaction terms, which are most often calculated separately for each interaction effect model in statistical analyses (Reineke, 1999), in a last analysis step the interaction terms for Integrating and Coordinating capacity have both been included simultaneously in the model. Following Reineke (1999), by linking the integrated interaction effect terms with the linear part of the theoretical model, iteratively an adequate statistical representation of the holistic model can be obtained, whereby the modelling is not only restricted on linear relationships any more. The results are presented in Figure 6.13 below.

As the results show, good model fit was also achieved for the holistic model, with all model fit indices indicated excellent fit with a χ^2/df (=1.510), GFI (=0.962), AGFI (=0.908), TLI (=0.963), CFI (=0.982) and NFI (=0.956), this was supported by a non-significant χ^2 ($p>0.05$) and an RMSEA value of 0.056, again solely the RMR (=0.105) was slightly above the acceptable threshold for this research. Given these good results the model qualified for hypotheses testing.

Figure 6.13 Interaction Effect Model A and B - Integrating and Coordinating Capacity



χ^2 Chi-Square value	44.765	Tucker-Lewis Index (TLI)	0.963
Degrees of freedom	27	Comparative Fit Index (CFI)	0.982
p value	0.230	Normed Fit Index (NFI)	0.956
χ^2/ df value	1.510	Root Mean-Square Error (RMSEA)	0.056
Goodness-of-Fit (GFI)	0.962	Root Mean Squared Residual (RMR)	0.105
Adjusted Goodness-of-Fit (AGFI)	0.908	Consistent Akaike Information Criterion (CAIC)	291.9

Hyp.	Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	Techno. Knowledge	RR	0.228	0.000	0.228	4.095***	YES
H2	Sensing capacity	RR	n.s	0.192	0.192	n.s	YES
H2a	Sensing capacity	Market Knowledge	0.154	0.127	0.281	2.056*	YES
H3	Learning capacity	RR	n.s	0.232	0.232	n.s	YES
H3a(1)	Learning capacity	Techno.Knowledge	0.378	0.114	0.492	6.312***	YES
H3a(2)	Learning capacity	Market Knowledge	0.310	0.000	0.310	4.000***	YES
H2b/3b	Market Knowledge	Techno.Knowledge	0.366	0.000	0.366	6.174***	YES
H4	Integrating capacity	RR	0.252	0.176	0.428	3.878***	YES
H4a	**Integr. X TechnoK.**	**RR**	**0.162**	**0.000**	**0.162**	**2.572***	**YES**
H5	Coordinating capa.	RR	0.270	0.000	0.270	3.741***	YES
H5a	**Coord. X TechnoK.**	**RR**	**- 0.008**	**0.000**	**- 0.008**	**- 0.131(ns)**	**NO**
H6a	EO	Sensing capacity	0.162	0.000	0.162	2.653**	YES
H6b	EO	Learning capacity	0.163	0.095	0.258	3.081**	YES
H6c	EO	Integrating capa.	0.142	0.036	0.178	2.263*	YES
H7a	NO	Sensing capacity	0.455	0.000	0.455	7.430***	YES
H7b	NO	Learning capacity	0.214	0.246	0.460	3.545***	YES
H7c	NO	Integrating capa.	0.298	0.101	0.399	4.309***	YES
Add	NO	RR	0.232	0.264	0.496	4.376***	YES
Add	EO	Market Knowledge	0.157	0.105	0.262	2.429*	YES

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level

As the results from the path analysis presented in Figure 6.13 further show, interestingly, the moderation (interaction) effect Integrating capacity has on the relation between Technological Knowledge and RR was found to be stronger (exhibiting coefficients of 0.162) when the interaction effect variable Coordinating*Technological Knowledge was included in the model. At the same time the moderation (interaction) effect Coordinating capacity has on the relationship between Technological Knowledge and RR emerged as insignificant (exhibiting coefficients of -0.008) when the interaction effect variable Integrating*Technological Knowledge was included in the model. These results may indicate that the moderating role of Coordinating capacity on the relation between Technological Knowledge and RR may be restricted as long as Integration is given, suggesting the need for a greater consideration of Integrating capacity as an accelerator for RR in firms. Notably, Coordinating capacity is shown to directly influence the outcome measure of RR (with a strong, direct effect of 0.270), but did not significantly affect the relation between Technological Knowledge and RR (as long as Integration is provided).

In conclusion, for each suggested mediation effect an interaction effect model was formulated in accordance to equation (3) $Y = \alpha + \beta_{yx}X + \beta_{yw}W + \beta_{yxw}XW + \zeta$. In a first research step, these models were tested by means of multi-group moderation analysis. The multi-group comparisons showed the moderation effect of Integrating and Coordinating capacity on the relation between Technological Knowledge and RR to be present and considerable meaningful. The results gave statistical support for H4a and H5a, confirming that both Integrating and Coordinating capacity strengthen the positive relationship between Technological Knowledge and RR. In a second step the significance of this interaction effect could be confirmed by means of interaction effect method due to non-linear SEM, which also gave support to H4a and H5a. Hence, the analysis strategy as suggested by Jonsson (1997), to first applying multi-group analysis, before testing the more complex model formulation for the non-linear interaction effect model, has proved to be reliable: For both models, A) Integrating capacity and B) Coordinating capacity, moderation effects were confirmed by means of multi-group analysis and confirmed when including interaction effect variables separately in the non-linear structural models. Interestingly, and this could only be shown by means of interaction effect method, when both interaction effect variables, Integrating and Coordinating capacity, were simultaneously included in the model, the significant moderation effect of Coordinating capacity turned insignificant, connecting the support for H5a on the presence (resp. absence) of Integrating capacity.

6.8 Competing Models

After all hypotheses have been tested and different models have been presented in this chapter, the following section conclusively offers a comparison of the models presented in this research against competing models. Following Jahn (2007), when different causal relationships between the variables are conceivable, a comparison of the alternative, competing models is deemed valuable.

For the comparison of competing models, a variety of different statistical criteria are referred to in the literature, all aiming to give indications on which model is the most parsimonious (Hooper et al., 2008). The model fit indices, as presented for each model, especially the CFI and CAIC, can give indications for such a comparison. However, to ensure comparability between models (and hence its indices), the models should be similar in the level of complexity (Jahn, 2007). For this research model, fit indices were evaluated independently from parsimony considerations, to avoid placing a disadvantage on models that are having more parameters, but at the same time – in case simpler alternative models exist and show similar good results – taking simplicity of the models into account. Nested models are regarded as useful, as here only the relationships between constructs are changed, meaning that specific paths are added to or removed from the model (Jahn, 2007).

As recommended by Morgan and Hunt (1994) the proposed models with its competing models are compared based on the following criteria:

(1) the **overall model fit**, as implied by the fit of the postulated and observed covariance matrices, and measured by the goodness-of-fit indices (especially the comparative fit index (CFI), where higher values of the CFI indicate towards the better alternative);

(2) the **percentage of hypotheses supported** in the model, measured by the relation between those parameters that showed statistical significant results and all others;

(3) the **explanatory power** of the model, as described by the variance explained in the outcome variable, and measured by its squared multiple correlation; and

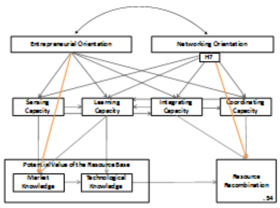
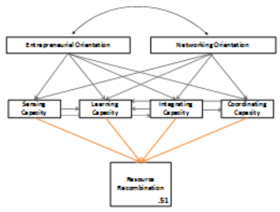
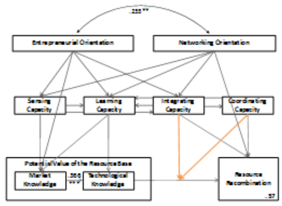
(4) the **models` parsimony**, as measured by the parsimony fit indices (especially the CAIC, whereby the model, that displays the lowest value for the CAIC is regarded the most superior[29]).

For a comparative investigation Table 6.18 below confronts the criteria for the three competing models for this research: (A) the re-specified model as outlined in chapter 6.5.4 (and presented in Figure 6.4), (B) a simple direct effect model, were only direct effects from the DCs to RR were

[29] As the absolute and incremental fit indices do not account for differences in parsimony, the CAIC was used as a comparative measure for model`s parsimony. Beside the AIC and CAIC, Jöreskog (1993) and Brown and Cudeck (1993) describe alternative measures as the CVI and ECVI used for the cross-validation of a single model as well as for the comparison of competing models.

allowed, and (C) the interaction effect model as presented in the previous chapter 6.7.2 (and shown in Figure 6.13). The arrows indicate a deterioration ↓, improvement ↑, or constancy ↔ of the obtained value compared to the re-specified model.

Table 6.18 Analyses of the Competing Structural Models

No.	Criterion	(A) Re-specified Model*	(B) Direct Effect Model**	(C) Interaction Effect Model***
	Graphical Representation			
	Characteristics	mediators included, no moderators	no mediators, no moderators	mediators included, moderators included
(1)	χ^2 Chi-Square value	26.366	14.644	44.765
	Degrees of freedom	13	3	27
	p value	0.090	0.012 ↓	0.230 ↑
	χ^2/ df value	2.028	4.888 ↓	1.510 ↑
	Goodness-of-Fit (GFI)	0.973	0.981 ↑	0.962 ↓
	Adjusted Goodness-of-Fit (AGFI)	0.908	0.821 ↓	0.908 ↔
	Tucker-Lewis Index (TLI)	0.955	0.870 ↓	0.963 ↑
	Comparative Fit Index (CFI)	0.984	0.981 ↔	0.982 ↔
	Normed Fit Index (NFI)	0.969	0.977 ↑	0.956 ↓
	Root Mean-Square Error (RMSEA)	0.070	0.137 ↓	0.056 ↑
(2)	% of Hypotheses supported	20/22 (90 %)	14/17 (82 %) ↓	21/22 (95 %) ↑
(3)	Squared Multiple Correlation	53.6	51.00 ↓	57.0 ↑
(4)	Consistent Akaike Info. Criterion (CAIC)	229.2	173.1 ↑	291.9 ↓

Re-specified Model vs. Direct Effect Model

In line with what RBV literature suggests the results of the re-specified structural model revealed a strong and positive effect of a firm`s knowledge based resources (Market and Technological Knowledge) on RR performance in firms ($\beta = 0.195$, $p<0.001$). Furthermore, it was supported that the firm`s resources mediate the performance effects *Potential Building DCs* (Sensing and Learning capacity) have on resource value creation through RR. In order to further analyse and test this mediating role of the firm`s resources, an alternative model was tested where the path between *Potential Building DCs* and Market/Technological Resources was omitted, and instead only direct paths between DCs and RR were allowed (direct effect model).

Looking at criterion (1) the **overall model fit** the results showed, that while the CFI for this competing, direct effect model remained at the same level (CFI = .981 versus .984), except of the GFI = .981 and NFI= .977 which slightly improved, a substantial deterioration of all other model fit indices was obtained (given a significant X^2 ($p<0.05$), $\chi 2/df = 4.888$, AGFI = .821, TLI=0.870, RMSEA = .137).

Concerning criterion (2) the **percentage of hypotheses supported,** the results show that only 14 of 17 (82.35%) hypothesised paths are supported at the $p<0.05$ level for the competing, direct effect model. In contrast, 20 of 22 hypothesised paths (90.1%) are supported at the $p<0.05$ level in the original, re-specified model. Importantly, only three of the four direct effects of the DCs on RR were significant in the rival model, while all four DCs have significant direct or indirect effects on RR in the proposed, re-specified model for this research.

In regard to the criterion (3) the **explanatory power** of the model, it is shown that for the competing, direct effect model the squared multiple correlation of RR furthermore decreased to 51% of variance explained, thus leading to an inferiority of explanation power. Hence, substantial higher explanatory power is gained through the additional paths included in the re-specified model, compared to the direct effect model.

Lastly, looking at criterion (4) the **models` parsimony**, as expected the decreasing complexity (17 versus 22 paths) of the direct effect model against the re-specified model lead to a difference in parsimony. The re-specified model's CAIC of 229.2 exceeded the competing model's CAIC of 173.1. Hence for this criterion, the competing model showed better results, as model parsimony increased with decreasing CAIC values (Diamantopoulos and Siguaw, 2000). However, as no guidelines exist for determining what a significant difference in model parsimony values is, and for the reason that all other criteria showed inferior results for the competing, direct effect model, an increment of 32.4% in CAIC was sacrified (see Morgan and Hunt, 1994).

In sum, comparing the two models, three out of four criteria revealed a deterioration of model fit for the competing, direct effect model. Therefore, the re-specified model chosen for this research could sustain the comparison against the direct effect model. The results thus support the RBV literature and this research`s argumentation, that the proposed impact of *Potential building DC* on performance is mediated by the resource base.

Re-specified Model vs. Interaction Effect Model

Given that the re-specified model outperformed the direct effect model, in a last step the results of the re-specified model and the interaction effect model were compared against each other. This was deemed valuable in order to additionally test if the moderating role of the *Value Realising DCs* (Integrating and Coordinating capacity) actually resulted in a perceivable better model-fit, from a more holistic viewpoint. Confirming the conceptual model developed on the basis of the literature review, the comparison of the two models revealed the following results:

Regarding criterion (1) the **overall model fit**, for the majority of model fit indices notwithstanding its complexity, the interaction effect model showed improved model fit compared to the re-specified model. In detail, improved values were shown for the $\chi2/df = 1.510$, TLI = 0.963, and RMSEA = 0.056; while the CFI= .982 and AGFI = .908 remained at the same level; only the GFI = .962 and NFI = .956, while remaining on a high level, did not show an improvement in comparison to the model without interaction effect.

Looking at criterion (2) the **percentage of hypotheses supported,** for the interaction effect model, 21 of 22 (95.45%) of hypothesised paths were supported at the $p<0.05$ level. In contrast, only 20 of 22 hypothesised paths (90.1%) were supported at the $p<0.05$ level for the in re-specified model.

Criterion (3) the **explanatory power** of the model showed, that the squared multiple correlation for RR increased from 53% of variance explained in the dependent variable by the re-specified model to 57% of variance explained by the interaction effect model, meaning that additional explanatory power is gained from the additional paths in the interaction effect model.

Lastly as expected, looking at criterion (4) the **models` parsimony**, the results showed a deterioration of the CAIC value form 229.2 for the re-specified model to 291.9 for the interaction effect model, were the two moderating effects were added in the model. For the same reasoning as described above, an increment of 27.4 % in CAIC was scarified by the higher explanatory power gained for the interaction effect model.

In brief, the comparison of the two models revealed an improvement in three out of four criteria for the interaction effect model, in comparison with the re-specified model. As a result of the comparison of competing models, the interaction effect model conceptualised in this research, not only proved to be the most adequate model when reflecting the theoretical considerations behind this research, but moreover sustained the comparison against competing models based on reliable statistical criteria, and hence could be confirmed as being the adequate model for representing and testing the causal relationships suggested in this research.

6.9 Chapter Summary

This chapter outlined the results of the quantitative research step using SEM principles. First, the process of data preparation and analysis was outlined. This was followed by a description and discussion of the results from the EFA and CFA, undertaken to build the one-factor congeneric **measurement models** used for the computation of the latent constructs in the structural model. Goodness-of-fit indexes were specified and one-factor congeneric measurement models presented for each multi-item construct, including the assessment of construct reliability and validity, common method bias (CMB) and measurement model invariance. Given excellent values for construct validity and reliability, the results further indicated that CMB was not a pervasive issue and that configural and metric invariance was established as the model parameters replicated well across group. Thus the one-factor congeneric measurement models qualified for the calculation of composite variables, which were calculated for all multi-item constructs and used in the structural path model. Moreover the procedure used for the computation of the formative construct RR was detailed and justified.

The subsequent section of the chapter finally outlined the results of the **structural path model**. Therefore the conceptual model as descried in chapter 3 (and specified in chapter 4) and its proposed hypotheses were tested by means of structural path analysis used to test the causal relationship between the constructs. Following the investigation of the model fit indices, based on empirical and theoretical considerations the conceptual model was re-specified with the aim to achieve a more parsimonious, well-fitting model. Given the achieved good overall model fit for the re-specified model, the individual path coefficients were presented and hypotheses were tested. The results of the **structural path analysis provide support the majority of hypotheses**, while only two hypotheses had to be rejected due to non-significant p-values. Table 6.19 provides an overview of all hypotheses tested in this empirical research and summarises the results from the quantitative research step.

Finally the **mediation and moderation effects** were further analysed by means of mediation, multi-group moderation and interaction effect analysis. The results gave evidence to the mediating role of Sensing and Learning capacity and the moderating role of Integrating and Coordinating capacity. In a final analysis step, the structural (interaction effect) model used in this research was conclusively assessed against competing models, confirming its superiority against alternative measurement models and thus it adequacy for measuring and testing the causal relations in this research. While the results are presented and partly discussed in this chapter, a detailed discussion of the findings is provided in the following chapter.

Table 6.19 Hypotheses Support

Hypo.	Independent variable	Dependent variable	Predicted Relationship	Support
	Potential Value of the Resource Base	**RR**	**Positive**	
H1	Technological Knowledge	RR	Positive	Confirmed
H1 (1)	Market Knowledge	RR	positive (indirect)	Confirmed
	Controls	**RR**		
H1a	Knowledge Complementarity	RR	Positive	No influence
H1b	Knowledge Tacitness	RR	Negative	No influence
H1c	Knowledge Context Specificy	RR	Negative	No influence
H1d	Knowledge Origin	RR	Positive	No influence
	Overall DC	**RR**	**positive (indirect)**	
H2	Sensing capacity	RR	positive (indirect)	Confirmed
H3	Learning capacity	RR	positive (indirect)	Confirmed
H4	Integrating capacity	RR	positive	Confirmed
H5	Coordinating capacity	RR	positive	Confirmed
	Potential Value of the Resource Base	**Potential Building DCs on RR**	**mediating**	
H2a	Sensing capacity	Market Knowledge	Positive	Confirmed
H3a (1)	Learning capacity	Technological Knowledge	Positive	Confirmed
H3a (2)	Learning capacity	Market Knowledge	Positive	Confirmed
H2b / H3b	Market Knowledge	Technological Knowledge	Positive	Confirmed
H2c / H3c	Technological Knowledge	RR	Positive	Confirmed
	Value Realising DCs	**Potential Value of the RB and RR**	**moderating**	
H4a	Integrating capacity	Technological Knowledge on RR	moderating	Confirmed
H5a	Coordinating capacity	Technological Knowledge on RR	moderating	**Partly confirmed**
	Entrepreneurial Orientation	**Dynamic Capabilities**	**Positive**	
H6a	Entrepreneurial Orientation	Sensing capacity	Positive	Confirmed
H6b	Entrepreneurial Orientation	Learning capacity	Positive	Confirmed
H6c	Entrepreneurial Orientation	Integrating capacity	Positive	Confirmed
H6d	Entrepreneurial Orientation	Coordinating capacity	Positive	**Rejected**
	Networking Orientation	**Dynamic Capabilities**	**Positive**	
H7a	Networking Orientation	Sensing capacity	Positive	Confirmed
H7b	Networking Orientation	Learning capacity	Positive	Confirmed
H7c	Networking Orientation	Integrating capacity	Positive	Confirmed
H7d	Networking Orientation	Coordinating capacity	Positive	**Rejected**

Chapter 7: Discussion, Managerial Implications and Directions for Future Research

7.1 Introduction

The RBV and DC literature has highlighted the importance of the firm`s resources and DCs for value creation trough the recombination of resources. By explicitly embedding the DC perspective in resource based explanations for value creation, the principal aim of this research was to bring clarity to the notion of DCs, their role and effects towards building RRs in firms. Accordingly, the overall objective of this study was to better understand the role of DCs in the process of RR, and thereby to elaborate the framework conditions of RR from the DC perspective.

Therefore, a number of objectives have been addressed, namely (1) to develop a conceptual framework and measurement model of a specific set of DCs relevant for the process of RR, (2) to empirically investigate the influence of a firm`s DCs on RRs, and (3) to examine the factors influencing the development of a firm`s DC to better understand how organisations can strategically foster the development of a firm`s DC, and thus RR in firms.

In order to approach these objectives, a first empirical investigation of the DC construct and its influence on RR was conducted. Based on a thorough literature review of the resource and competence based literature, several research gaps were identified and a conceptual model, including a number of respective propositions and hypotheses, was developed. In a subsequent step, first qualitative research was conducted to explore the accuracy of the conceptual model and to refine it for the second, quantitative research step. The results of the quantitative research step, the structural path analysis, model re-specification, as well as moderation and mediation analyses, were presented in the previous chapter.

In this chapter, the research findings are discussed in more detail. Based on the discussion of the findings, managerial implications are derived. Thereafter limitations of the study are pointed out and contributions to theory and practice are outlined. Before concluding, the chapter closes with directions for future research. Finally a summary of the last chapter is provided.

7.2 Discussion of the Findings: Key Drivers of Resource Recombination

The quantitative data offered considerably support for the research model. Besides examining the role and effects of Sensing, Learning, Integrating and Coordinating capacities in the process of RR, the influence of organisational resources in the relationships was further studied. Additionally, Entrepreneurial Orientation (EO) and Networking Orientation (NO) were identified as antecedents for the development of DCs, and their influence was empirically tested in this research. The individual findings of the quantitative research step are discussed in the following section.

The discussion of the findings thereby is divided into three sections, picking up the three originally formulated propositions, which guided through this research, and based on which the studies` hypotheses were derived and tested. The discussion of the research findings provides important insights into how theories of resource and competence based research, strategic management and entrepreneurship can be integrated and extended, what managerial implications can be derived, and what future studies should explore.

7.2.1 The Influence of the Resource Endowments on Resource Recombination

The following section discusses the findings regarding the influence of resource endowments on building the potential value of the resource base for RR. It thereby addresses Proposition 1.

Proposition 1: A high valuable resource base is positively associated with RR in firms. The potential value of the resource base for RR thereby is influenced by certain characteristics of the resources.

Investigating if certain characteristics of the resource base – its quality, diversity, complementarity, transferability, deployment flexibility, and renewal – influence the potential value of the resources for RR in firms, several hypotheses were derived in order to address Proposition 1. The advanced understanding of the potential influence of specific characteristics of the resources on RR offers important insight into resource value creation in firms. Moreover it allows answering the questions, what is relatively more important for RR in firms, the resources or the DCs of the firm, and how the interplay between both factors is organised in practice. Regarding the influence of resource endowment on RR, the empirical results as outlined in chapter 6 yield two key findings, which will be further discussed in the following:

(1) The overall quality and diversity of the resources play a considerably larger role in resource value creation than its origin, tacitness, context specificy, or complementarity.

(2) Resources are important for building the potential value for RR and are a key driver of RR, but even more important are the firm`s DCs.

First, the influence of specific characteristics of the resources on RR was tested. Thereby, most interestingly, the results showed the potential value of the resource base for RR to be predominantly influenced by the **Quality and Diversity of Market and Technological Knowledge**, measured by its knowledge depth and breadth, while surprisingly, no significant effects were found in this study between **Knowledge Complementarity, Knowledge Tacitness, Knowledge Context Specificy, Knowledge Origin** and RR. The results therefore led to a rejection of H1a, H1b, H1c, H1d, implying that regardless of specific characteristics of resources – their complementarity, tacitness, context specificy, and origin – an increase in Market and Technological Knowledge depth and breadth significantly increases RR in firms. In other words findings imply that as long as firms hold a considerably amount of qualitative and diverse Market and Technological Knowledge, any further characteristic of that knowledge does not play a major role for resource value creation. A possible explanation of this might be that as long as firms possess the necessary DCs, especially Integrating and Coordinating capacities, they do have the necessary abilities to integrate, build and reconfigure those resources into new bundles and thereby to unearth the potential value of those resources (Madhavan and Grover, 1998, De Luca and Atuahene-Gima, 2007), irrespectively of their characteristics. In consequence, the characteristics of resources, be it its complementarity, tacitness, context specificy, or origin, become irrelevant in regard to performance outcomes. As a result, evidence is given by the research findings that the overall quality and diversity of resources play a considerably larger role in resource value creation than its origin, tacitness, context specificy, or complementarity.

Second, another key finding is that regarding their impact on RR, the resources a firm possess (measured by its Market and Technological Knowledge breadth and depth) emerge to be a key driver of RR, but data reveals that even more important are the firm`s DCs. Looking at the standardised total effects, which comprise the complete influence one variable has on another variable throughout all conceivable relationships with additional constructs, **Technological Knowledge** (breadth and depth) was confirmed to have a strong, positive effect on RR, with coefficients ranging from 0.195 in the generic (re-specified) model to 0.228 in the final interaction effect model. Also **Market Knowledge** (breadth and depth) revealed an admittedly weaker, yet significant positive, indirect effect on RR through Technological Knowledge (ß = 0.063). Thus, the fundamental influence Technological and Market Knowledge has on RR was clearly established, confirming H1 and H1 (1). In line with the RBV`s perception of value creation in firms, findings hence approved that a high valuable resource base was found to significantly influence RR. At the same time, and this is probably the more notably finding, the influence of the DCs on RR is shown to be relatively more important, with strong and positive standardised total effects revealed for Sensing capacity (ß = 0.185*/ 0.192**[30]), Learning capacity (ß = 0.225*/ 0.232**), Integrating capacity (ß = 0.428*/ 0.428**), Coordinating capacity (ß = 0.267*/ 0.270**) on RR. According to these findings, resources certainly are confirmed to be an important element and inherent for value creation in firms, as they establish the potential value of the resource base for RR, but even more important as possessing valuable resources are the DCs to build and translate them into realised value. In consequence both, the resources as well as the firm`s DCs, emerged as key drivers of RR.

[30] For reasons of comparison values are reported for the *generic (re-specified) model and the **final interaction effect model.

The results thus validate the significant focus of the DC literature on developing the necessary capabilities to reconfigure its resource base, as the key source of competitive advantages in dynamic environments (Eisenhardt and Martin, 2000, Teece et al., 1997, Mathews, 2002). While being consistent with previous findings in the DC literature, claiming that considerably emphasise should be placed on the development of DCs in firms (Pavlou and El Sawy, 2011, Hawass, 2010), at the same time the results contradict, or one could also say extend the traditional focus of the RBV, which sees a firm`s competitive position primarily determined by the specific characteristics of firm resources (Schreyögg and Conrad, 2006, Barney, 1991, Grant, 1991). Instead, findings support the idea of an interplay between the resources and DCs as major source for new, innovative RRs in firms.

Therewith, this study produced results that corroborate the findings of previous work in the DC field (e.g. Hansen et al., 2004, Kor and Mahoney, 2005, Holcomb et al., 2009), which found that while owning or having access to high valuable resources is necessary for a competitive advantage, they must be effectively managed and synchronised *to realise* a competitive advantage. As a result, evidence is given by the research findings that a substantial proportion of variance in resource productivity across firms can be explained by the differences attributed to the firm`s DCs relevant for the selection and recombination of resources, while the availability of resources only builds the basis for the development of RRs.

One of the issues that emerges from these findings is that firms should leave their traditional focus on merely possessing the "right" resources to take on a more holistic approach towards developing the necessary capabilities to manage those resources. Thus, rather than solely focusing on specific characteristics of the resource base, which - except for resource quality and diversity - proved to be irrelevant in regard to performance outcome of RR anyway, special emphasis should be given by managers on the development of DCs. These findings have important implications for resource value creation in firms, which will be discussed in chapter 7.3.

7.2.2 The Role of Dynamic Capabilities in the Process of Resource Value Creation

The conceptual model, hypotheses and findings presented help to delineate key differences in regard to the role of DCs in the process of resource value creation. The following section discusses these findings, addressing Proposition 2.

Proposition 2: A firm`s overall DC is positively associated with the amount of RRs in firms due to both building and exploiting the potential value of the resources base.

The principal aim of this research was to bring clarity to the notion of DCs, their role and effects towards RRs by *building* and *exploiting* the resource base. Investigating what the role and effect of different DCs in the process of RR is, and whether different types of DCs are work on different levels, several hypotheses were derived to test the proposed mediation effect of the resource base between Sensing/Learning capacities and RR, and the proposed moderation effect of Integrating/ Coordinating capacities on the link between the resource base and RR. Instead of addressing a firm`s overall DC, the study thereby investigated the way in which specific dimensions of the DC construct, independently and jointly influence RR in firms. Due to the complexity of analyses applied for testing moderation and mediation effects, the findings regarding the proposed mediation and mediation effects have already been presented and discussed in great detail in the previous chapter (refer to section 6.6. and 6.7). For this reason, this section provides merely a brief review and integration of the previous discussion.

Findings give evidence that regarding the role and effect of the specific DCs in the process of resource value creation, two different types of DCs can be distinguished: *Potential Building DCs* and *Value Realising DCs*, whereby both components have different effects and 'working modes' towards RR. Correspondingly, the study has three key findings, which are discussed in the following:

(1) The Sensing and Learning capacities are necessary for building the potential value of resources for RR, and thus can be referred to as *Potential Building DCs*.

(2) The Integrating and Coordinating capacities are necessary for the value potential of the resource base to become realised by creating, implementing and exploiting new innovative RRs, and thus can be referred to as *Value Realising DCs*.

(3) Both the *Potential Building DCs* and the *Value Realising DCs* are critical to the achievement of superior performance in the long run. *Potential Building DCs* and *Value Realising DCs* thereby have separate but complementary roles.

First, as the results of the structural path analysis and mediation analysis in particular showed, high **Sensing and Learning capacities** generally lead to an increased performance in regard to RR. However, as not all firms that have developed high Sensing and Learning capacities are subsequently high performing in achieving RRs, this relation was expected to be fully and positively mediated by the resource base (Market and Technological Knowledge). Literature therefore suggested that Sensing and Learning capacities per se do not result in superior innovation performance, rather they help to provide the basis for subsequently leveraging innovation opportunities (Helfat and Peteraf, 2009, Lichtenthaler, 2012). Confirming what theory suggested, statistical support was given by the quantitative data analysis, manifesting that Market and Technological Knowledge fully mediate the effect of Sensing and Learning capacity on RR in firms ($p<0.05$), thus confirming H2a/H2b/H2c and H3a/H3b/H3c. In other words, evidence was given by the data that the direct relationship between Sensing capacity, respectively Learning capacity and RR is better explained through the mediator variables of Market and Technological Knowledge.

Notably, while Learning capacity emerged to have a strong positive, and direct effect on building the potential value of Market Knowledge (ß = 0.310) and Technological Knowledge (ß = 0. 391), Sensing capacity, while still significant, showed to have a relatively low *direct* influence on Market Knowledge (ß = 0.154), though yet a strong *indirect* effect on both Market Knowledge (ß = 0.281) and Technological Knowledge (ß = 0.408) through Learning capacity. This allows the conclusion that, besides its direct effect on Market Knowledge, Sensing capacity finds its expression through Learning. It therewith supports the argumentation by several researchers (e.g. Pavlou and El Sawy, 2011, Lichtenthaler, 2012) that a high Sensing capacity, which focuses on the identification of new opportunities in the external environment [external opportunity generation], also acts as enabler of a strong Learning capacity, as it is suggested to facilitate the firm`s ability to address external opportunities through creating new and utilising existing knowledge [internal opportunity generation]. Taken together, it can be said with statistical certainty that both, Sensing and Learning capacities, significantly contribute towards building the potential value of the resource base.

As an important result, research findings thus confirm the suggested role of Sensing and Learning capacities as *Potential Building DCs* in the process of RR, as they help to build the relevant resources for RR. While results imply that firms with a higher Sensing and Learning capacity tend to recombine their resources more effective, data also indicate that even if firms have high Sensing and Learning capacities, this will not necessarily lead to higher RR performance, unless they use these capacities to build a valuable knowledge base, the 'raw material' for RR. Most notably, the results of this study statistically confirm and specify the argument proposed earlier by Ambrosini and colleagues (2009), that it is the DCs - more specifically the *Potential Building DCs* - that directly impact the firm`s resource base by continuously refreshing the stock of resources, and thereby enable firms to 'hit a moving target', seen as the source of firm`s competitive advantage.

Second, the results of the moderation analysis furthermore gave support to the perceived role of **Integrating and Coordinating capacities** as *Value Realising DCs*. As formulated in H4a and H5a, Integrating and Coordinating capacities were expected to moderate the relation between the resource base and RR. Hence, moderation analysis techniques were applied to test whether high or low levels of Coordinating and Integrating capacities have different effects on the relation between Technological Knowledge and RR. Besides its strong direct effect on RR, the results of the multi-group comparison confirmed the moderating role of Integrating and Coordinating capacity. The positive influence Technological Knowledge has on RR was proved to be 2.6 times as strong when Integration capacity was high, and 1.6 times as strong when Coordinating capacity was high. Moreover, the relation between Technological Knowledge and RR became insignificant ($p>0.05$) when Integrating and Coordinating capacity were low, which denotes that only if firms possess high Integration and

Coordination capacities, will the resources a firm holds, lead to higher success in RR. In consequence this means, that even if a firm has high levels of Market and Technological Knowledge, it does not necessary lead to the desired performance outcome, if the firm does not possess the relevant capacities to integrate and coordinate that knowledge in order to achieve new RRs. The results thus gave statistical support for H4a and H5a, confirming that both Integrating and Coordinating capacity strengthen the positive relationship between Technological Knowledge and RR.

The significance of this moderation effect was further validated by means of interaction effect method. Notably, while the interaction effect of Coordinating capacity was confirmed as significant (ß = 0.098, $p < 0.05$), it did not show to be as strong as it revealed for Integrating capacity (ß = 0.156, $p < 0.05$). This result is somewhat surprising, given the strong direct effect of 0.280 from Coordinating capacity to RR. Interestingly, in a further analysis when both interaction effect variables - Integrating and Coordinating capacity - were simultaneously included in the model, the significant interaction effect of Coordinating capacity turned insignificant ($p > 0.05$), connecting the support for H5a on the presence (respectively absence) of Integrating capacity. These results may indicate that the strong focus on coordination mechanisms as moderating variable may be restricted as long as integration is given, suggesting the need for a greater consideration of processes and routines supporting inter-action and communication. Findings therefore sustain the assumption that different DCs will be working in very different ways, according to the situation in which the firm is found at any given time (Madsen, 2010). Future research should set out to further analyse and confirm these findings. Notably, given the strong direct effect Coordinating capacity has on RR (which remains similar strong across models), its influence on resource value creation remains unaffected. From the four DCs, Coordinating capacity emerged to have the strongest direct effect on RR, while Integrating capacity exhibited to have the strongest total effect throughout the models. These results validate the signi-ficant focus of the DC literature on the concept of integration and coordination for value creation.

Briefly said, these results confirm the suggested role of Integrating and Coordinating capacities as *Value Realising DCs* in the process of RR, as they help to leverage the value potential of the resource base by creating, implementing and exploiting new innovative RRs. These findings are consistent with qualitative research results and corroborate results of previous studies in this field, which has often highlighted the role of Integrating and Coordinating capacity as critical in the process of resource value creation in firms (e.g. Pavlou and El Sawy, 2011, Galunic and Eisenhardt, 2001, Galunic and Rodan, 1998), due to its influence on the realised value of RR in firms (e.g. Grant, 1991, Sirmon and Hitt, 2003). In total, quantitative data revealed that the effort and investment provided by firms to build and renew their resources has a similar strong influence on resource value creation in form of new RRs, as their efforts in building and maintaining strong Integrating and Coordinating capacities. Consequently, high Integration and Coordination capacity appears desirable for firms.

Taken these findings together, they suggest that both the *Potential Building DCs* and the *Value Realising DCs* are critical to the achievement of superior performance in the long run. Hence, evidence is given by the research findings that much of the variation in firm`s performance is explained by the variation in their level of DCs. Important implications for resource management therefore are that in order to stay competitive in dynamic environments firms have to develop both *Potential Building DCs* and *Value Realising DCs*. The findings suggest that firms lacking *Potential Building DC*s will not generate a rich and diverse knowledge base, the 'raw material' for innovation, while firms lacking *Value Realising DC*s might indeed have a valuable resource base, however at the same time will not be able to exploit the value creation potential of the resources.

Third, findings clearly reveal that *Potential Building DCs* and *Value Realising DCs* have separate but complementary roles. As the firm's ability to successfully create value through RR depends on having adequate strength in both complementary capacity modes, meaning that each single capacity (Sensing, Learning, Integrating and Coordinating capacity) can act as a potential 'bottleneck', limiting a firm`s overall ability to strategically develop RRs. For example, the utility of strengthening Sensing and Learning capacities may reveal relatively limited if a firm lacks Integrating and Coordinating capacities (see Lichtenthaler, 2012). Although a firm`s Integrating and Coordinating capacity is not easy to develop, managers ought to recognise that the mere accumulation of resource assets does not guarantee a sustainable competitive advantage over time (Isobe et al., 2008). This implies that having strong *Potential Building DCs* may be a necessary but insufficient condition for improved value creation performance in firms. Instead, "in a rapidly changing environment, firms need to continuously search for new competence bases and reconfigure their existing portfolio of competences" (Isobe et al., 2008, p. 424). On the other hand, firms cannot possibly leverage the value creation potential of its resources without first having built the relevant stock of knowledge through acquisition and assimilation activities.

In order to avoid theses trade-offs, firms have to develop systematic approaches to find and maintain a strategic balance between a *Potential Buildings* and *Value Realising DCs,* its underlying routines and processes. Hence, the results are consistent with Sanchez (2004, p. 531) noting that "organizational competence does not depend simply on achieving excellence in one or two key success factors, but rather on developing an interrelated and balanced set of success factors". Accordingly an important implication in turn is that firms have to strive to achieve a proper balance and alignment among these two distinct subsets of DCs. While the existing literature tends to ignore the effects of DCs on performance outcomes, this study demonstrated that different capabilities have different effects and 'working modes' and therefore should be treated separately in future research.

From a broader perspective, these findings also complement March`s (1991) seminal paper on exploration and exploitation, where he discussed the difficulty of finding and maintaining this balance, and as such research findings give support to the initial idea that "routines [that are constituting a DC - author`s note] could provide the microfoundations and the key mechanisms by which firms both explore and exploit" (Parmigiani and Howard-Greenville 2010, p. 442). Thus, with the DC framework presented here, this research presents one possible approach that could help managers to find the right balance between exploration and exploitation, by simultaneously developing both *Potential Building* and *Value Realising DCs.*

7.2.3 The Antecedents for the Development of Dynamic Capabilities

The development of firm`s DCs was suggested to be influenced by a variety of firm- and network-level antecedents. Addressing the last Proposition 3, the following section discusses the findings regarding a firm`s Entrepreneurial Orientation (EO) and Networking Orientation (NO), which were proposed to positively influence the development of a firm`s DCs.

Proposition 3: Entrepreneurial Orientation and Networking Orientation act as antecedents for the development of a firm`s DCs.

Investigating what the influence of a firm`s EO and NO on the development of the firm`s DCs is, several hypotheses were derived to address Proposition 3. This research set out to investigate, whether a high degree of EO, respectively NO, has a positive influence on the development of a firm`s DCs, and consequently RR. Moreover, the relatively importance of the proposed antecedents was tested, and in addition whether NO and EO act as complements or rather as substitutes.

Evidence is given by the research findings that (besides possessing the necessary DCs) achieving RR success to a great extend depends on a firm`s organisational structure and culture supportive of interorganisational and entrepreneurial activities, which positively affect the development and utilisation of DCs for resource value creation. Regarding the antecedents of DCs, two key findings can be deduced, which are further discussed in the following:

(1) Entrepreneurial Orientation and Networking Orientation act as antecedents for the development of DCs.

(2) While Networking Orientation emerged as relatively more important than Entrepreneurial Orientation for resource value creation, both are complementing each other in their perceived role of developing Sensing, Learning and Integrating capacities.

First, the firm`s **Entrepreneurial Orientation** was confirmed by the data to be positively associated with the development of the firm`s DCs, and consequently RR. While a vast variety of studies assumed a direct linkage between EO and RR, respectively firm performance (e.g. Wiklund et al., 2002, Zahra and Wiklund, 2002, Covin and Slevin, 1991, Zahra, 1991), no study could be found that further investigated the activities or 'vehicles' – suggested in this research as firm's DCs – through which a firm`s entrepreneurial culture is transformed into effective RRs (Wiklund et al., 2002). This research therefore set out to examining the relationship between EO, DCs and RR in more detail.

Empirical findings confirmed the *indirect* effect EO has on RR through developing DCs. Indeed, EO emerged to only have a moderate direct impact on RR, where no significant *direct* effect was shown to be existent when being tested in the generic model. Instead, it revealed by the data that the relationship between EO and RR is better explained by its positive effect on DCs, through which EO is translated into new RRs. Hereof, EO was shown to act as significant and relatively strong direct predictor for Sensing capacity (ß = 0.162, $p < 0.01$), Learning capacity (ß = 0.163, $p < 0.01$), and Integrating capacity (ß = 0.142, $p < 0.05$), confirming H6a, H6b, H6c, proposing that EO is a necessary precondition for DCs to develop over time. Moreover, its direct effect on Market Knowledge emerged in the data analysis as comparable strong (ß = 0.157, $p < 0.05$), approving literature that proposes a direct effect of EO to the stock of available knowledge (Wiklund and Shepherd, 2000, Chockburn et al., 2000). Interestingly, less support was found for its effect on Coordinating capacity, leading to a rejection of H6d.

The overall results, yet demonstrated the importance of EO as an important antecedent for the development of DCs, which in consequence positively affects RR in firms. This research therefore elaborated previous research and established a more detailed explanation of the interrelationship between EO on performance outcomes, such as RR.

Second, findings clearly showed that **Networking Orientation,** which captures the firm`s tendency to embed close interactions with external entities in their business, moreover is an important antecedent for resource value creation in firms. The firm`s NO already emerged in the qualitative research as extremely relevant for value creation in firms, and was confirmed by the quantitative data to be strongly related to RR, in two different ways, *indirectly* through the development of DCs, and most interestingly also *directly*.

Implied by the modification indices but also well-grounded in theory, NO revealed by the data to have a strong direct effect on RR in firms (ß = 0.237, $p < 0.001$). The high support for NO as a critical factor for RR is in line with previous findings from network theory (Mu and Di Benedetto, 2011, Mu and Di Benedetto, 2012) and DC literature (Isobe et al., 2008, Chi, 1994, Harrison et al., 2001, Larsson and Finkelstein, 1999, Madhok and Tallman, 1998), proposing that firms with strong network ties are more accessible to external resources and thereby enlarge their stock of available resources and opportunities to extract value through RRs. Accordingly, the high level of new (external) knowledge and its constant exchange inherent to value creation in firms may explain the significance of NO as a key driver of RRs. Besides its strong *direct* effect on RR, NO was moreover confirmed to influence RR *indirectly* through its substantial contribution to the development of the firm`s Sensing capacity ($ß$ = 0.455, $p < 0.001$), Learning capacity ($ß$ = 0.214, $p < 0.001$), and Integrating capacity ($ß$ = 0.299, $p < 0.001$), confirming H7a, H7b, H7c. Notably, likewise for EO, no direct effect was found between NO and Coordinating capacity, leading to a rejection of H7d. Accordingly, both NO and EO only indirectly affect Coordinating capacity through the other DCs. One possible explanation may be found in the rationale that a higher tendency and openness to entrepreneurial and interorganisational activities may negatively affect the ease of coordination, as it provides considerably more opportunities for value creation and in consequence raises the complexity of implementation. Future research should further investigate that findings.

In sum, evidence was given by the findings that interfirm collaboration is a very effective means of enhancing DCs, and thus RRs. In other words, findings confirmed that firms with a higher NO will develop an increased ability to purposefully create, extend and modify its resource configurations (Mu and Di Benedetto, 2012) by improving its Sensing, Learning and Integrating capacities. In line with what literature suggested (e.g. Isobe et al., 2008), especially for small and medium-sized firms with limited resources, a high level of NO thus strengthens its resource position and enhances their DCs for RR by providing new external resources bases through the creation of networks of collaboration.

Finally, looking at the relative importance of the proposed antecedents and whether they act as complements or substitutes, two important implications can be made. First, the overall results demonstrate the importance of both, NO and EO as relevant antecedents for developing DCs and for resource value creation. Remarkably, in the model NO emerged to be the overall strongest predictor for RR in firms ($ß$ = 0.496, $p < 0.001$, total effect). Given the strong direct impact NO has on the outcome variable of RR, the lack of a direct link between EO and RR may appear somewhat surprising at the first glance, but can be well explained by its indirect effect on the DCs. As a result, even so the influence EO has on DCs is admittedly lower compared to NO, it should not be underestimated for its perceived role in developing the firm`s Sensing, Learning and Integrating capacities. Second, findings clearly indicate that EO and NO complement each other in terms of their impact and effect. While both constructs describe the firm`s *willingness* or *attitude* to engage in entrepreneurial and networking activities, findings indicate that they act as complements rather than substitutes, because EO captures firm`s attributes such as *innovativeness*, *proactiveness*, and *risk-taking*, describing the degree to which firm`s growth objectives are driven by initiatives rather coming from inside the firm (*endogenous*), while NO reflects its tendency to engage in interorganisational initiatives, thus their triggers are rather coming from outside the firm (*exogenous*).

Taken together and interpreting these findings from a more holistic viewpoint, quantitative data clearly confirmed what was suggested by literature: While a firm`s NO and EO primarily reflect the *willingness* or *attitude* of the firm concerning the engagement in interfirm collaborations, and entrepreneurial activities respectively, the DCs refer to the *activities* itself which build, develop, integrate and reconfigure internal and external resources. Thereby the DCs of the firm indeed build the decisive factor for resource value creation, however, if firms do not possess a supportive strategic orientation, often these capabilities would remain untapped. In other words, if the organisational framework conditions would not be put into place, in consequence the firm`s capacities would not take their full effect. For this reasoning and revealed by the quantitative data, the firm`s NO and EO were confirmed by this research to act as important antecedents for the development of the firm`s DCs, and thus RR, and can be regarded as necessary pre-condition for an efficient and effective resource value creation in firms.

As presented above, with respect to three originally formulated propositions, overall seven key findings regarding (i) the influence of the resource endowments on RR (chapter 7.2.1), (ii) the role of DCs in the process of resources value creation (chapter 7.2.2), (iii) and the antecedents for the development of DCs (chapter 7.2.3) could be derived and were discussed in this section. The discussion of the key findings offered insights into the key drivers of RR in firms, and thus helped to better understand the interrelationship between DCs, the resource base of the firm, and innovation in the form of RR. Respectivly the aim and objectives of this research were met to a large degree. On the basis of these findings and the related discussion, important managerial implications for resource management could be derived, and will be discussed in the following.

7.3 Managerial Implications

A number of managerial implications arose from the discussion of key drivers and antecedents. Based on the advanced understanding of the specific DCs, their role and effect in building RRs in firms, as well as their antecedents, systematic ways for the development of DCs to successfully implement RRs in a firm`s innovation strategy can be derived. Moreover, with the DC framework presented this research offers a measurement model of DCs, while at the same time exploring the underlying processes and activities of each capacity to be strategically implemented for resource management (Pavlou and El Sway, 2011). Doing so, this research counteracts the criticism that DCs cannot be measured, and that they are born, not made (Winter, 2003). In practical terms, based on the key findings discussed above three main implications for managers can be derived.

First, findings have shown that possessing high valuable resources is important for building the potential value for RR. At the same time findings revealed that as important as the resources themselves, are the DCs to leverage those resources. Accordingly, before outlining any individual implications for managers derived from the discussion of the key drivers and antecedents, first of all a broad understanding of the interplay between resources and capabilities should be established in firms to successfully implement the concept of RR and to enable a holistic, integrated view of resource management in firms. Establishing this multi-faceted view is especially important, when considering that until recently academia and practice predominantly focussed on possessing the 'right' resources as being the imperative for value creation in firms (e.g. Peteraf, 1993, Peteraf and Barney, 2003). However, in times where firm`s boundaries are becoming more and more indistinct and open (e.g. Chesbrough, 2003, 2006), and interorganisational collaboration becomes common practice (e.g. Isobe et al., 2008, Rothaermel, 2001, Lane and Lubatkin, 1998, Lee et al., 2001), solely having access to resources is not the decisive factor anymore. Rather it is the intelligent management of those resources available, which comes in the centre of interest (Holcomb et al., 2009, Hansen et al., 2004, Kor and Mahoney, 2005). For firm`s management aiming at strategically fostering RR, this means that it is not possible if the senior management opposes the idea of internal capacity building, and instead continuous a strategy, that is solely concentrating on the resources. In practical terms, referring to the literature on continuous innovation, a senior management initiative is recommended to ensure an overall understanding and application of those principles (Boer, 2004). Accordingly, management should be conscious of their willingness and abilities towards building both, the required resources <u>and</u> internal capacities (as well as framework conditions) with respect to RR. To enable this, expectations, goals and objectives should be clearly debated and potential obstacles resolved internally to ensure a mutual understanding and to enhance commitment before any organisational actions are initiated. Additionally, incentive systems that foster rather than restrict capacity development should be implemented. Employees from all levels, but first and foremost the top management level, should manifest a shared belief in value creation through RR and support the RR process through the allocation of time, money, training, and other resources, so that everyone can participate by being actively involved.

Second, the research findings further gave evidence that both the *Potential Building DCs* and the *Value Realising DCs* are critical for the achievement of superior performance in the long run. As *Potential Building DCs* and *Value Realising DCs* fulfil separate but complementary roles, and RR success depends on having adequate strength in both complementary capacity modes, managers are required to develop systematic approaches to find and maintain a strategic balance between both complementary capacity modes. With the DC framework and respective measurement model presented here, this research offers a valuable instrument and actionable guidance for managers to (1) identify and understand internal DCs, (2) measure and assess the status quo of each capacities for resource management, (3) evaluate their strength and weaknesses and benchmark them against competitors, and finally (4) define targeted strategies for purposefully developing and enhancing those capacities identified as bottlenecks. Thus, by presenting an actionable set of DCs and at the same time an instrument for assessing strength and weaknesses, the DC framework allows managers, to systematically outbalance existing shortcomings in order to find and maintain the right balance between *Potential Building* and *Value Realising DCs*. This is given, as the DC framework details and explains DCs as managerially-amenable processes and routines that decision-makers can readily act upon (Pavlou an El Sawy, 2011). Doing so it helps managers to implement the relevant routines and processes in order to support each respective capacity mode (for a detailed description of those processes and routines refer the DC framework, Table 3.1, chapter 3.4.1.7). Looking at the individual implications for managers this means, they should install this instrument to regularly (re-) assess the development of firm´s DCs over time in order to constantly monitor and maintain the continuous process of resource management. This is especially relevant, as DCs develop over time, and thus managers need to adopt a long-term strategy, such as to set up pre-defined milestones and establish clear responsibilities and process owners. Notably, although DCs have been viewed and measured at the firm level manifesting their relevance for managers at the top level, their implementation in day-to-day routines and processes impacts all organisational levels, and therefore also demands the involvement of lower level managers (Pavlou and El Sawy, 2011).

Third, evidence was given by the findings that the firm`s Entrepreneurial Orientation (EO) and Networking Orientation (NO) are important antecedents for the development of DCs and RR, and thus can be regarded as a necessary framework condition, crucial for the efficient and effective resource value creation in firms. Accordingly, to facilitate the actual recombinant activities implemented through Sensing, Learning, Coordinating and Integrating capacities for RR, findings imply that both, a firm`s NO as well as a firm`s EO, should be embedded within "the social fabric of organization" (Hawass, 2010, p. 410). To put this into action, managers are encouraged to actively promote and stress the firm`s willingness to embed close interactions with external entities, and at the same time develop a positive attitude towards being engaged in entrepreneurial activities, in order to act towards creating and maintaining an organisational structure and culture supportive of interorganisational and entrepreneurial activities. Notably, findings advice that the firm`s activities intended to orchestrate multiple types of network ties and to engage in entrepreneurial activities should come with strategic intent, rather than being the result of relatively unforeseen actions (Mu and Di Benedetto, 2012).

For managers this means, in order to systematically foster a firm`s EO, which stands for a culture of change and transformation, that they have to actively contribute towards developing an organisational culture open for entrepreneurial actions by enabling and encouraging staff to engage in dialogues, becoming involved in entrepreneurial activities, and participating in the process of experimentation (Shane and Venkataraman, 2000). Moreover managers are encouraged to value, and actively contribute to the development of new ideas, support novelty, experimentation, and creative processes in order to achieve continuity (Lumkin and Dess, 1996, Wiklund and Shepherd, 2003). Also it is important to offer staff trainings, mentoring programs, support and appropriate incentive systems and hire people passionate about, and experienced in entrepreneurship (Zahra and Wiklund, 2002, Wiklund et al., 2002).

Correspondingly, related implications can be given for managers in respect to developing and strategically fostering a firm`s NO, which was revealed by the data to have an even stronger effect on developing DCs and RR. Accordingly, managers first of all need to be aware that a firm`s NO represents a key element by which recombinant innovation can be leveraged. Especially when striving to collaborative RR efforts, managers will need to actively encourage their employees to learn new knowledge by incorporating knowledge from external network partners, which also enables them to critically revise their own processes, products and services, technologies, and resources, and thereby enhance their capacity to conjointly create and develop products that meet the market demand (Mu and di Benedetto, 2011). Rather than being reluctant to new network ties, managers thus are encouraged to adopt a business strategy that stresses effective and efficient location of network partners, management of network relationships, and improvement of network performance. This should come along with managerial actions directed towards developing new network ties to access new resources, expose new opportunities and obtain new knowledge (Mu and Di Benedetto, 2012). It may include hiring people from different industries and disciplines to orchestrate strong network ties in various industries and business areas. Another aspect is to develop corporate strategies empowering groups to contribute to interorganisational activities and maintain relationships the organisation wants to retain. Associated with those actions are regular staff trainings, mentoring programs, support and appropriate incentive systems.

Table 7.1 outlines the managerial implications for resource value creation through RR, developed based on the key findings and discussion of the research results presented in the previous chapter. Besides giving important implications for managers, this study has also some potential limitations, which are presented and discussed next.

Table 7.1 Managerial Implications for Resource Management

Findings	Managerial Implications	… at the Top Management Level	… at Lower Management Levels
I. Resources are important for building the potential value for RR and thus are a key driver of RR, but even more important as the resources are the firm`s DCs to leverage those resources	I. Establish a mutual understanding of the interplay between resources and capabilities at all management levels	Develop a holistic, integrated view and strategy of resource management to ensure an overall understanding and application of those principles	o Manifest a shared belief in value creation through RR, so that everyone can participate o Discuss expectations, goals, and objectives and resolve potential obstacles to ensure a mutual understanding and commitment o Allow an extensive amount of time, money, training and rewards to overcome unfamiliarity and potential prejudices o Offer staff training, mentoring, support and appropriate incentive systems that foster rather than restrict capacity development o Hold not only formal discussions but also informal events to develop a common understanding and shared experiences o Implement corporate strategies empowering groups towards building both, the required resources and internal capacities for RR
II. Potential Building DCs and Value Realising DCs fulfil separate but complementary roles. Both capacity modes are critical for the achievement of superior performance	II. Find and maintain the strategic balance between Potential Building and Value Realising Capacities	Understand and regularly (re-)assess internal DCs to systematically outbalance existing shortcomings by developing and enhancing … a) a firm`s Sensing Capacity b) a firm`s Learning Capacity c) a firm`s Integrating Capacity d) a firm`s Coordinating Capacity, respectively	(1) Identify and understand internal DCs (2) Measure and assess the status quo of DCs for resource management (3) Evaluate their strength and weaknesses and benchmark them against competitors (4) Define targeted strategies for purposefully developing and enhancing those capacities identified as bottlenecks (5) Implement processes and activities for the respective capacity, defined in the DC framework (6) Set up pre-defined milestones and establish clear responsibilities and process owners (7) Regularly (re-)assess the development of firm´s DCs over time to constantly monitor and maintain the continuous process
III. Entrepreneurial Orientation and Networking Orientation are important antecedents for the development of DCs and RR	III. Implement an organisational structure and culture supportive for entrepreneurial and networking activities	Develop a high Networking Orientation by actively promo-ting the firm`s willingness to embed close interactions with external entities	o Implement an organisational culture and group mechanisms that enable staff to engage in dialogues and become involved in entrepreneurial activities. o Foster informal communication, staff exchange and mixed teams, personal networking o Empower groups to contribute to inter-organisational activities o Hire people from different disciplines to orchestrate strong network ties in various business areas
		Develop a high Entrepreneurial Orientation by supporting a positive attitude towards being engaged in entrepreneurial activities	o Encourage personal to engage in dialogues, becoming involved in entrepreneurial activities, and participating in the process o Value, and actively contribute to the development of new ideas, support novelty, experimentation, and creative processes o Offer staff training, mentoring programs, and appropriate incentive systems and hire people passionate about, and experienced in entrepreneurship

7.4 Limitations of the Research

While this research considerably contributes to the resource and competence based research and all aims and objectives as formulated were fully met, it also has some limitations. Consequently research results should be interpreted in the knowledge of its limitations.

First, notwithstanding that a sufficiently large sample size was achieved for the calculation of the structural measurement model, few analyses, namely the multi-group moderation analysis and the measurement model invariance test, necessitated to divide the sample into two sub-groups. Considering the smaller sample size of these sub-groups, the statistical power of the results should be treated with caution (Diamantopoulos and Siguaw, 2000), unless the findings are being confirmed by an independent, preferably larger sample (Plewa, 2010).

Second, one further limitation of this study is also related to the research`s approach of obtaining the data. Given the lack of archival data or external objective scales available for measuring the constructs of this study, this research was obliged to rely on self-reported assessments of the respondents. Thus, for the majority of constructs perceptual scales were used. The study hence is limited to this point. To prevent the data from being potentially biased by the subjective evaluation of single respondents, future studies might not only rely on one response from the focal firm`s management, but moreover interview a second respondent, or even third parties (Barreto, 2010) in order to gain dyadic data. Alternatively, objective proxies may be consulted, for example, King and Tucci (2002) employed experience measures, which might be appropriate for use in future studies to assess some of the propensities composing the DC construct (Barreto, 2010).

Third, as noted earlier, opposed to the principal nature of SEM, the procedure of model re-specification is not confirmatory but exploratory in nature (Byrne, 2001, Diamantopoulos, 1994, Diamantopoulos and Siguaw, 2000). Even though only slight modifications were made to improve model parsimony (only two additional path were added), and the changes were justified based on literature, the re-specification may be built on specific peculiarities of the given sample. The re-specified path model is thus limited to the given sample and should therefore be verified by means of an independent sample in the future (Diamantopoulos, 1994, Hoyle and Panter, 1995, Plewa, 2010).

Fourth, the final measurement of the RR construct may encompass further limitations of this study. Due to the lack of alternative, reliable and valid scales for measuring RR in the literature, the construct of RR was conceptualised as a second-order formative construct formed by the four different types of RR, and adopted the scale as originally developed by Zahra and Wiklund (2002). The lack of discriminant validity among the measures intended to capture the four different types of

RR, however, led to the elimination of several items for the one-factor congeneric models, and resulted in the use of two-item measures for Type 2, 3, and 4 of RR, and a three-item measure used to measure Type 1 of RR in the final analysis. While the remaining items were assumed to appropriately reflect the nature of the different types of RR as defined and conceptualised for this research, nonetheless the difficulties with the measurement of the RR construct may be related to the unfamiliarity of industrial representatives with the nomenclature and the respective items. Given that RRs can take many forms (Zahra and Wiklund, 2002) alternative proxis for RR, e.g. innovation or creation of new business as applied in past research (Rumelt, 1987), may also be appropriate for assessing single aspects of RR in firms, and may be easier to access by industry. Future researchers therefore should investigate and validate alternative RR measures.

Lastly, as this research focused on resource management practices in UK companies to avoid the impact of national culture issues, the generalisability of the findings to other countries may be limited (Plewa, 2010). Despite the limitations of this research, its contribution to theory and practice is apparent and will be further specified in the following section.

7.5 Contributions of the Research

The overall contribution this research is expected to make is to develop a better understanding of RR in firms from a DC perspective, by exploring the relationships between DCs, the resource base of the firm, and innovation in the form of RR. By means of developing and quantitatively testing a conceptual model of factors that influence RR in firms, this research provided a first empirical investigation of the concept of RR and the construct of DC, presenting a holistic, integrated picture of influencing factors of RR from a DC perspective. With the conceptual model presented, this research offered a more precise definition of the firm`s DCs, shedding light on their role and effects towards developing new RRs and separating them from their antecedents and consequences.

With the investigation of the concept of RR from a DC perspective, this PhD research significantly contributes to the resource and competence based research. The primary contributions this research is expected to make, is inherently related to five characteristics of this research, namely (1) the conceptual elaboration of the DC framework, their microfoundations and underlying routines, (2) the empirical investigation of influence of firm`s resource endowments and DCs on RR in firms, (3) the empirical analysis of firm- and network-level antecedents for the development of DCs, (4) the qualitative and quantitative research setting, and (5) the integration of the established RBV and the emerging DC literature.

Doing so, the findings contribute to theory and practice by improving the understanding of organisational factors influencing the likelihood of RR to occur. At the same time, by investigating the DCs of the firm and their influence on resource value creation, this research further extends the resource and competence based theory by explicating the role of DCs in the process of RR, which allows to gain insights about the extent to which DC actually account for the variance in firm's performance outcomes. Therewith, this research not only contributes towards opening up the black box of RR in firms, but moreover helps to establish DC as a theoretically, well-founded and useful construct in strategic management theory. Overall, this research makes several contributions to both, theory and practice as outlined below.

7.5.1 Contribution to Theory

The **contribution to theory** this thesis is expected to make can be regarded as follows:

First, by explicitly embedding the DC perspective in resource based explanations for value creation, this research specifies the joint role of (i) a specific set of *DCs of the firm*, and (ii) its *resource endowments* in conjunctly achieving new RR by building and exploiting the potential value of the resources. By explicating how this interrelation affects RR in firms, this research extends resource and competence based theory, as it integrates the DC perspective and the RBV and thus replaces the relative static approaches used in most of the previous research on the RBV. Doing so, this approach contrasts the majority of RBV literature, according to which observable performance differences between firms can primarily be led back to the different resources that are available within the firm at one point in time (Barney, 1991, Grant, 1991, Miller et al., 1996, Freiling et al., 2006). Considering the variety of benefits organisations seek from effectively structuring and managing their resources and bundle them into valuable new RRs in order to leverage their value creation potential (Sirmon et al., 2007), a narrow focus on the availability of valuable resources was deemed overly restrictive. Hence, with the integration of the DC perspectives in the resource based explanations for value creation, specifically looking at the capabilities firm`s need to develop to reconfigure and change their current resources, this research works towards the dynamisation of the RBV, and thereby tries to overcome the limitations of past research in this field.

Second, the conceptual model, hypotheses, and discussion presented within this research help to delineate key differences in the role and effects of the specific DCs. With the DC framework established in this research, which explicates a specific set of DCs necessary for the process of RR and enhances the understanding of the microfoundations underlying each capacity, this research established the basis for exploring how these components interact with their environment and what role they have in value creation in firms. By specifically focusing on how DCs build and exploit the firm`s resource endowments by leveraging the potential value of those resources through building new RRs, this study expands previous studies of the RBV and DC literature. Hence, explicating that different DCs have different roles and effects on the resource base – Sensing and Learning capacities are working towards building the resource base (*Potential Building DCs*), while Integrating and Coordinating capacities are working towards exploiting the resource base (*Value Realising DCs*) – this research helps to develop an enhanced understanding of DCs and how they operate. Shedding light on how differences in capabilities contribute towards explaining heterogeneity in innovation performance among firms, this research represents a clear extension of the DC literature and contributes to research on its efficiency. Thereby, this research brings clarity in the notion of DCs and offers valuable insights into the source of variance in organisational performance outcomes.

Third, by differentiating specific capabilities and their different effect on different levels in the process of RR, this research extends the DC literature, where most of the previous research studies bunches all DCs together and only provides a quite imprecise picture. Moreover, it goes beyond traditional research by not only looking at the DC constructs but also by investigating the underlying strategic orientation - Entrepreneurial Orientation and Networking Orientation – and its influence on the development of DCs. Hence, with the integration of environmental contingency factors (Entrepreneurial and Networking Orientation) at the same time, it enhances knowledge about the RBV, which has often been criticised for "being insular and overly focused on internal firm attributes" (Sirmon et al., 2007, p.289).

Finally, while some authors have argued that "it is difficult for researchers to fully explain how firms use resources and capabilities to create competitive advantage" (Helfat and Peteraf, 2003, p.997), the conceptual model presented here opens up the black box of RR in firms. This study is one of the few studies in the resource and competence based research adopting SEM method for incorporating the multifaceted effects of resource endowments, DCs, and their antecedents, into the model of RR in firms. Therewith, unlike traditional regression analytical approaches, this research allows to quantitatively test the systematic linkages among these variables (Isobe et al., 2008) and to explain associations between the antecedents to and consequences of DCs in the process of resource value creation in firms. Therewith, this research offers a theoretical and empirical base for new research integrating the DC perspective and RBV, and thus helps to further develop an important area of research, where strategic management and entrepreneurship intersect. Besides, this research has shown that traditional research methodology can be fruitfully applied to RBV (Miller and Shamsie, 1996, Zahra and Wiklund, 2002). Enhancing current knowledge of managing the process of RR in dynamic environments, this research creates a learning opportunity for theorists and practitioners and provides an important contribution to the innovation theory and practice. These results contribute to our understanding of resource management and provide empirical evidence for the importance of a firm`s DCs in the RBV.

Summarising, while the impact of resources endowments and DCs on resource value creation in firms has been considered in isolation, their joint interaction effect has never been examined. Integrating knowledge from the established RBV and the emerging DC literature, this research investigated the relation between the different DCs, the resource base and its performance outcomes RR, and thereby provided an essential step towards establishing a coherent theory by means of governing the relationships between constituting variables and therewith providing a more precise, integrated picture on how RRs in firms are build.

7.5.2 Contribution to Practice

Besides its contribution to theory, this research also offers a variety of practical contributions, as the range of managerial implications presented previously has already shown. Earlier research findings have already pointed out, that well-known companies often embark on a 'resource-based strategy', however that this strategy often is not enough to sustain a competitive advantage over time in dynamic environments (Teece et al., 1997, Teece, 2007). Instead findings indicate, that "winners in the global marketplace have been firms that can demonstrate timely responsiveness and rapid and flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences" (Teece et al., 1997, p. 515). However up to today, observations of current management practice have shown that the concept of DCs is still not well known, neither sufficiently applied in strategic management. Accordingly, by elaborating on the source of variance in firm performance, this research contributes to establish a better understanding of RR in firms from a DC perspective, and thereby establishes important knowledge for resource management practice, highlighting that as important as the resources themselves are the DCs to build and exploit the value creation potential of the resources.

Therefore, the **contribution to practice** this paper is expected to make, can best be described in the words of Ambrosini et al. (2009, p. 44): "For dynamic capabilities to be a useful construct [for strategic management] it must be feasible to identify discrete processes inside the firm that can be unambiguously causally linked to resource creation." Correspondingly, by investigating a set of specific, measurable DCs, addressing (i) what their underlying processes and routines are, (ii) how certain types of DCs work onto the resource base, and (iii) what their role and effects are in establishing RR in firms, this research offers a detailed elaboration of the DC concept and links it to resource value creation in firms. Doing so, this research delves into the micro mechanisms of DCs, how they are developed, and how they work. Moreover, with the DC framework presented this research offers a simple method for managers to conceptualise, operationalise, and measure DCs in firms and thereby makes a first step towards establishing DC as a theoretically well-founded construct, in order to become one that is also managerial relevant.

The results of this research thus can help managers, (1) to better understand the impact of resource endowments and DCs on everyday resource management practice, (2) to improve organisational efforts for developing DCs, and (3) thereby to create new opportunities for RR in firms. As a result resource value creation in firms will be better understood by industry and a framework can be built to systematically develop DC in order to utilise the exploitation of the potential lying in RR. In doing so this research addressed Ambrosini and Bowman`s direction to further research, who emphasised that generating a deep understanding of "how, in practice, dynamic capabilities are created, (…) would allow us to start developing guidance for managers about how they can deliberately develop dynamic capabilities" (Ambrosini and Bowman, 2009, p. 45).

In brief, the contribution to practice this research is expected to make is first and foremost to establish an enhanced understanding of how resource value is created in firms. With the DC framework presented and the conceptual model applied, this research offers a procedure of practical use that enables firms to develop and evaluate a common RR strategy. Doing so, this research aims to contribute to the business field by providing practically usable results. The desirable function of this methodology would be that the process of RR in firms would not be left to chance – as it is mostly the case in today's businesses – but a framework is provided that can be utilised for the systematic initialisation and exploitation of the value creation potential lying in RR. The intended results are that by strategically developing DCs and applying them to RR management practice, single companies or networks of collaborating 'RR clusters' can create new innovations based on RR principles, define new markets or exploit existing market potentials more sustainable and with less effort in terms of time and financial resources.

7.6 Directions for Future Research

Besides its contributions to theory and practice presented in the previous section, this research provides several directions for future research. While this research significantly contributed to develop a better understanding of RR in firms from a DC perspective, more research on the topic needs to be undertaken before the association between resources, DCs and RR, as well as their antecedents is fully understood and a coherent theory of resource value creation in firms is established. Several important issues emerge, that should be investigated in future research.

First, the relationship between RRs and different levels or kinds of **firm`s performance outcomes** (e.g. growth and profitability) deserve empirical investigation in future studies. While there is a consistent claim in literature that RRs acts as a means for creating wealth (Wiklund et al., 2002, Kogut and Zander, 1992, Grant, 1996, Galunic and Rodan, 1998, Wiklund and Shepherd, 2009), only few empirical studies applying RR to firm performance outcomes have been conducted up to date. Further investigating this relationship is of special interest, particularly as researchers have argued, that probably not all RRs may consequently lead to wealth creation in the long run, given that there are also costs associated with their development (Zahra and Wiklund, 2002). Moreover, it might be suggested that different types of RRs may lead to different types of performance outcomes, e.g. Type 1 and 3 might contribute more to operational efficiency, while Type 2 and 4 might rather contribute to strategic performance. Therefore the effect of RRs on different levels or kinds of firm performance merit further examination (Isobe, 2008). Elaborating this relationship will require future studies to gather longitudinal data and also to find adequate ways of taking the costs into account. In the end the results will allow researchers to draw stronger conclusions about the importance of RR activities (Wiklund and Zahra, 2002).

Second, further research should be done to investigate the effect of **environmental dynamics** in the proposed model. While this study controlled for the likely effect of a variety of internal and external factors (e.g. environmental turbulence, company size, company age, etc.) on the development of RR in firms, it did not take the likely effect of environmental dynamics on the development of DCs into account, as suggested by literature (e.g. Teece et al., 1997, Brown and Eisenhardt, 1997). Madsen (2010) for example proposed, that different types of DCs may be working in very different ways, depending on the situation in which the firm founds itself. He further argues, that some capabilities might be more relevant under conditions of major changes in the firm (e.g. Sensing and Learning capacities, as they are associated with *exploration* of new external opportunities and internal knowledge creation), while others might be of greater importance in periods of internal pressure and cost efficiency (e.g. Integrating and Coordinating capacities as they are directed towards the *exploitation* of the existing resources and the development of new reconfigurations) (Madsen, 2010). This would imply that different DCs not only have different, and complementary working modes towards developing RRs, and moreover that internal resources as well as a firm`s strategic orientations (its EO and NO) have different effects on the development of DCs, as this research has shown, but moreover that various other situational firm factors may have an effect on how the DCs develop and unfold in practice. A logical effect of this would be that the relative importance and value of the resources and DCs, respectively, is very different across different environments, depending on the dynamics. Taken this research as a basis, future research may therefore evaluate the different environmental contexts that necessitates the possession of different DCs. Moreover, it would be of interest, for example, to study the use and development of DCs in young vs. established firms, or if the use of different types of DCs is different across industries (Ambrosini at al., 2009). On the basis of the theoretical and empirical foundation established in this research, further studies, which take these variables into account, will need to be undertaken.

Third, this research has emphasised the effect of organisational framework conditions on the development of DCs, thereby, however, it only concentrated on firm- and network-level antecedents grounded in the firm`s underlying strategic orientation (its EO and NO). While a wide range of different antecedents residing at individual-, firm-, and network-levels have been proposed in the literature (Rothaermel and Hess, 2007, Teece, 2007, Zollo and Winter, 2002, Eisenhardt and Martin, 2000), with some notable exception (e.g. Hawass, 2010, Rothaermel and Hess, 2007), little empirical research can be found, that set out to investigate the antecedent of the development of DCs. More quantitative research is needed on investigating other types of antecedents of the specific DCs, especially on the group, or individual levels. From an organisational behaviour perspective, Hawass (2010) for instance proposes that future research should investigate patterns of **managerial leadership styles** supportive for reconfiguration. Accordingly, a more participative leadership style, which is suggested to motivate individuals to actively contribute in decision making and idea generation, may be argued to build the basis for a structure and culture of transformation and change, and hence stimulate the development of DCs and RRs in firms (Hawass, 2010). On the basis of the proposed measurement model of DC and RR, future research should investigate these linkages. Besides empirically investigating the suggested relationships, future research could also conduct case studies on successful leaders, which have managed to successfully reconfigure their firm`s assets.

As outlined above, various directions for future research emerge from this research. While a number of questions remain for future research, the above outlined are only those regarded as most relevant for being addressed from the author`s view. In any case, with the DC framework and structural model presented, this research provides a theoretical and empirical base and opens avenues for new, integrative research in an area, which finds itsselves at the forefront of research agendas of many scholars (Zahra et al., 2006, Ambrosini at al., 2009). On this basis, future research should now set out to establish and extend this research`s understanding of resource value creation in firms from a DC perspective, its constituting variables, their key drivers, and antecedents. This would be the subsequent step in transforming the DC framework and model presented here into a coherent resource and competence based theory of value creation in firms.

7.7 Chapter Summary

The last chapter elaborated on the research results presented in the previous chapter. Therefore a detailed discussion of the findings that derived from the qualitative and quantitative data analysis, with the latter including model re-specification, hypotheses testing, as well as moderation and mediation analyses, was presented. First the findings regarding the influence of the resource endowments for resource value creation in firms were discussed in detail, were thereafter the specific role of DCs in the process of resource value creation and there interrelationships were analysed. This was followed by an in-depth discussion of EO and NO as the antecedents of DCs and RR outcomes. Based on the discussion of research findings, managerial implications were derived, providing recommendations for management, how to strategically foster the development of DCs and the process of RR in firms. Before concluding, limitations of this research were outlined and the contributions this research makes to theory and practice were presented. Finally some directions for future research were given.

APPENDICES

Appendix 2.1 Fundamental Publications of the Resource and Competence based Research

Author	Publication Title	Theory	Core Statement
Schumpeter (1934)	The Theory of Economic Development	Theoretical Foundation	The concept of creative destruction, innovations are a result of 'carrying out new combinations'
Penrose (1959)	The Theory of the Growth of the Firm	Theoretical Foundation	Firms can be distinguished by the heterogeneity of the available resources.
Wemerfelt (1984)	A Resource-Based View of the Firm	RBV	The success of a firm depends on their resource base.
Demetz (1988)	Knowledge-Based Theory of the Firm	KBV	Management of Knowledge
Hamel/ Prahalad (1990)	The Core Competence of the Corporation	CBV	Core Competences (CC) are bundles of resources and skills that constitute competitive advantages. CCs are the result of a collective learning process.
Cohen and Levinthal (1990)	Absorptive capacity: A new perspective on learning and innovation	CBV	Absorbtive capacity describes a firm`s ability to recognise the value of new, external information, assimilate it, and apply it to commercial ends.
Barney (1991)	Firm Resources and Sustained Competitive Advantage	RBV	Resources needs to be rare, valuable, difficult to imitate and non-substitutable in order to be source of growth.
Grant (1991)	The Resource-Based Theory of Competitive Advantage	RBV	The identification of resources (resp. RRs) as source for competitive advantage.
Kogut and Zander (1992)	Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology	CBV	The concept of combinative capacity describes a firm's ability to make efficient use of its resources to create new resource combinations.
Mahoney (1995)	Resource Dependence Approach	RBV	The Management of Resources and the Resource of Management
Grant (1996)	Organizational Capability as Knowledge Integration	KBV, CBV	The application and expansion of knowledge are the foundation for competitive advantages.
Teece/ Pisano/ Shuen (1997)	Dynamic Capability Approach	CBV	Competitive advantages develop through the ability to adaptability of competences. Dynamic capability are determined through the internal processes of the firm, the positioning of assets and the path dependence.
Hunt/ Morgan (1996)	The Resource Advantage Theory of Competition	RBV	A company's marketplace position and thereby financial performance results from a comparative advantage (disadvantage) in resources.
Sanchez/Heene (1997)	Competence-based Strategic Management	CBV	Competences define the ability to sustain the coordinated deployment of resources in ways that helps an organisation achieves its goals.

Appendix 2.2 Four Types of Resource Recombinations in Firms

(1) Existing Resources for Ongoing Business Initiatives (Cell1). Following Zahra and Wiklund (2002, p. 22) the first type of RR is defined as "the reconfiguration of a firm's [existing] resource inputs to make their use more efficient". It covers the re-deployment of the firms current resources to improve existing products, or expand services (Wiklund and Shepherd, 2009, referring to Bell, 1991, Bower, 1970, Markides, 1997), with the aim to achieve objectives more economically and efficiently (Zahra and Wiklund, 2002). It is closely linked to what is referred to as 'resource refinement' in literature, which involves the improvement of the existing asset portfolio (Isobe, 2009) and is directed towards the exploitation of existing resources. Hawass (2010) further proposed a similar mechanism, which he terms 'capability evolution', and that basically captures internal learning processes to modify its current capabilities, aiming to "contribute to the deepening of the firm's current capabilities by creatively reconnecting existing organisational systems to improve capability responsiveness to technological developments" (Hawass, 2010, p. 412). Therefore, this type of RR addresses the recombination of resources in its original meaning.

(2) New Resources for Ongoing Business Initiatives (Cell 2). The second type of RR refers to the "infusion of new [external] resources to improve efficiency, increase product variety, add new features to existing products, and enhance performance in new areas" (Zahra and Wiklund, 2002, p. 23, Wiklund and Shepherd, 2009, p. 200, going back to Grant, 1991). It is closely linked to what has been referred earlier in the literature as strategies for business enrichment (e.g. Baumol, 1993, Chandler, 1962, Day, 1994, Gluck, 1981, Hamel and Prahalad, 1994). Therewith, it encompasses a dynamic learning process that "facilitates business renewal by injecting and incorporating new domains of knowledge to the existing organizational system" (Hawass, 2010, p. 412). Lavie (2006) describes this type of RR to address the same function as the pre-changed capability, however with a clear and noticeable increase in performance and complexity.

(3) Existing Resources for New Business Activities (Cell 3). This third type of RR relates to "changing of the firm's mix of [existing] resource inputs to pursue new initiatives, such as extending the new product line, introducing new products, or entering new markets" (Zahra and Wiklund, 2002, p. 23, Wiklund and Shepherd, 2009, p. 200). It basically describes firm`s strategies related to business migration, as noted earlier in literature (e.g., Chandler, 1962, Fombrun and Ginsberg, 1990, Northcraft and Wolf, 1984, Porter, 1980, Leornard-Barton, 1995, Majumdar, 1998).

(4) New Resources for New Business Activities (Cell 4). This fourth type of RR refers to "the acquisition and use of these resource inputs to generate new products, goods or services for new markets" (Zahra and Wiklund, 2002, p. 23), as similarly described earlier in literature (e.g. Acs and Audretsch, 1990, Christensen, 1997, Connor, 1999, Foster, 1986, Rumelt, 1987). Firms might use this strategy to pursue radical innovations and position themselves as pioneer in the market (Acs and Audretsch, 1990, Chistensen, 1997). This type of RR is closely linked to what is referred as 'resource reconfiguration' in literature, which involves the restructuring of the asset portfolio through the integration of new assets (Isobe, 2009) and is directed towards the exploration of new opportunities. A similar concept has also been denoted by Hawass (2011, p. 412), entitled 'capability transformation', which basically captures "combining and connecting a firm's current domains of knowledge with new other domains located elsewhere in the industry". Accordingly the resulting type of RR "is the product of mixing internal knowledge with new external sources of knowledge" (Hawass, p. 412). Moreover, it is closely related to what has been described as "architectural innovation" (Henderson and Clark, 1990), while RR is the general case of which architectural innovation is a special case (Rodan, 2002).

Appendix 2.3 Further Discussion of Research Gaps

As the first introductory review of current literature has shown, the concept of RR to generate innovation has been widely discussed and is recognised as being significant in today's knowledge economy. Accordingly, the concept of RR has attracted considerable interest in the past with many publications from a variety of academic fields stressing its importance (e.g. Schumpeter, 1934, Usher, 1954, Penrose, 1959, Koestler, 1964, Bouette, 2004). Despite the high relevance of RR and the increasing interest from academia and practice, existing research in the area has not yet elaborated, how a possible framework for RR could be designed and established. Although the DCs of the firm to make use of its resources can be considered as a decisive factor, when it comes to successfully commercialising innovations (Matsumoto et al., 2005), the failure of firms to find systematic ways to identify, evaluate and combine existing resources successfully is well documented in research stemming from a lack of understanding of how organisations can strategically and practically approach and foster RR (Kliewe et al., 2009). Researchers put forward that firms have difficulties in understanding the "black box" involved in using valuable, rare, inimitable, and non-substitutable resources to gain and maintain a competitive advantage" (Sirmon et al., 2007, p. 288, Priem and Butler, 2001). To date, scarce research exists investigating how organisations can plan and execute RRs and what specific DCs are needed in order to successfully implement RRs (Sirmon et al., 2007).

As the recent increase in the exploration and exploitation of existing resources and capabilities can be seen rather as a trend from practice than a movement initiated by academia (Lichtenthaler, 2007), the insights in the determinants and antecedents of RR in firms have still been limited (Zahra and Wiklund, 2002). Few studies have examined the antecedents necessary for such RR to occur (Galunic and Rodan, 1998), and none have tested them empirically. However, there is a crucial need to understand how firms can effectively structure and manage their resources and bundle them into valuable new RRs in order to leverage their value creation potential (Sirmon et al., 2007). More precisely, the following research gaps could be derived and will be addressed in this thesis:

First, the literature on DCs has often been criticised for a lack of precise definitions, empirical grounding and measurement (e.g. Pavlou and El Sawy, 2011). This is in line with Williamson's tautological criticism of the RBV (Williamson, 1999). While a wide spectrum of different capabilities has been denoted under the "umbrella of Dynamic Capabilities" and an array of different processes and routines has been assumed to provide the microfoundations of DCs (e.g. Teece, 2007, Eisenhardt and Martin, 2000), there still is a lack of a consistent definition of a firm`s DCs. Moreover, few attempts have been made to categorise different capabilities and thus to develop a framework incorporating all different types of DCs referred to in literature (e.g. Madsen, 2010, Pavlou and El Sawy, 2011). To date there is still a poor understanding of the DC construct and its existence is often assumed without specifying their exact components (Galunic and Eisenhardt, 2001), which makes it difficult to approach. A clear and precise differentiation of the various capabilities, which are also assumed to be working in different fields (Barreto, 2010), is lacking. Instead, a firm`s DCs have rather been described as a "black box" (Pavlou and El Sawy, 2011). Following Felin et al. (2012, p. 1), "while much progress has been made in understanding routines and capabilities the underlying microfoundations or micro-level origins of these constructs have not received adequate attention", accordingly various questions remain regarding the underlying micro-level origins of DCs (Felin and Foss, 2005, Fellin and Foss, 2009, Teece, 2007, Argote and Ren, 2012, Felin et al., 2012, Teece, 2012). Taken together, there is an urgent need for a coherent framework and measurement model for DCs (GAP1). Only if the construct of DC is made observable, and semantically clarified - with an actionable set of specific, measurable DCs and a clarification of their underlying routines, processes and activities - the ambiguity and the inconsistence of the current concept can be overcome and implications for managers can be offered.

Second, while the literature consistently supports the view that RR activities should be particularly important in dynamic environments (Eisenhardt and Martin, 2000, Wiklund and Shepherd, 2009), what influence a firm`s DC has on the successful development of RRs has not yet been extensively investigated in the literature (Barreto, 2010), neither has it been measured empirically (Sirmon et al., 2007). Whereas the RBV traditionally concentrates on specific characteristics of the resource base (Barney, 1991), suggesting that the major source for new, innovative RRs in firms can be found in the resources itself, it is neglecting the role of resource management (Holcomb et al., 2009). Hence, previous research on the RBV has not provided sufficient information on how resources are used to create competitive advantages (Priem and Butler, 2001), or, as criticism by Barney and Arikan (2001), simply postulates “that the actions necessary to exploit resources are self-evident when they are not” (Sirmon et al., 2007, p.274).

On the other side, while important conceptual advancements have been made within the DC perspective concerning the relevance of DCs and how they are developed over time, only an inconsistent picture emerges concerning the effects and locus of where DCs are actually working (Madsen, 2010, Ambrosini and Bowman, 2009). Generally speaking, while the “congruence of a theory is defined by the laws of the relationship among its variables of interest” (Barreto, 2010, p.274), most of the DC and RBV literature is “characterized by insufficient formulation of clear, a priori statements regarding the relationships among key constructs or variables” (Barreto, 2010, p.274). More specifically, current literature is either only looking at the DCs and their influence on integrating, building and bundling new RRs, or it is solely concentrating on specific characteristics of resources and their influence on performance outcomes. Doing so, existing literature in the field tends to ignore the synergetic role of resources and DCs in conjunctly achieving RRs in firms. In consequence, “in-between creating access to heterogeneous resources and their ultimate effect on innovation lies unexplored territory, in the learning process between firms that starts when resources are brought together and subsequently combined” (Nooteboom, 2007, p.4). Hence, there is a crucial need to understand how to effectively build a high valuable resource base, bundle the resources into new RRs, and thereby exploit the value creation potential of the resources through building new RRs (Sirmon et al., 2007). To date, research looking at both, the resource base and the DCs at the same time, is still notably absent. Accordingly, an investigation of the DCs in relation to the resource base is lacking (GAP2).

Thus, investigating the relation between the different DCs, the resource base and its performance outcomes (here: RR) would provide an essential step towards establishing a coherent theory by means of governing the relationships between constituting variables and therewith providing a more precise, integrated picture on how RRs in firms are built. Moreover, it would allow to specify the role of DCs in the process of value creation in firms.

Third, there is a growing body of literature looking at the DCs from a slightly different perspective investigating the antecedents that may foster the development of DCs (e.g. Madsen, 2010).

Nevertheless existing literature “offers few empirical analyses that explore the processes inside and outside organizations that lead to dynamic capabilities” (Hawass, 2010, p. 414 f.), and only few studies have examined the organisational framework conditions that allow firms to systematically reconfigure its resources to improve innovation (Hawass, 2010, Macher and Mowery, 2009). Recent research has proposed various antecedents of DCs at the individual-, organisational- and network-level (Rothaermel and Hess, 2007). However, far too little attention has been paid to empirically investigating the influencing factors of the development of DCs, especially those that might be grounded in the firm`s underlying strategic orientation. Still, it is a quite unspecific picture that has been drawn, concentrating on multiple factors on various different levels and from different perspectives. It is not yet clear which factors influence the development of DCs within firms (GAP 3). Accordingly, this study responds to prior calls for research that explicates firm-related determinants that may explain the development of DCs (Zahra and Wiklund, 2002).

Fourth, to date empirical research from both the RBV and the DC perspective is still in their infancy (Hawass, 2010, Madsen, 2010). Thus, empirical research on the relationships between resources, capabilities and performance outcomes is still lacking. From the DC literature, while a growing number of researchers have taken exploratory research approaches to DC and performance outcomes, leading to a growing amount of normative and conceptual findings (e.g. Teece et al., 1997, Teece, 2007, Eisenhardt and Martin, 2000, Kogut and Zander, 1992), however, apart from a few, notable exceptions (e.g. Pavlou and El Sawy, 2011, Hawass, 2010) empirical research is still remarkably absent. An analogous picture emerges looking at RBV literature, while tremendous conceptual advancements have been made in this area within the last decade, the majority of studies investigating resource endowments and performance outcomes are exploratory in nature (e.g. Barney, 1991, Galunic and Rodan, 1998, Rouse and Daellenbach, 1999). Most of them are based on qualitative studies, and only little quantitative research has been conducted to date. A quantitative validation of the role of DCs and the resource base in the process of value creation in firms is still missing (GAP4). Hence, these propositions should be validated empirically.

Appendix 3.1 Notions of Dynamic Capabilities found in the Literature

Type of DC	Related Concepts	References
Sensing Capacity	Sensing Capacity	Pavlou and El Sawy (2011)
	Sensing Capabilities	Teece (2007)
	Sensing Capability	Lichtenthaler (2012)
	Ability to scan the environment to evaluate the markets and competitors	Teece et al. (1997)
	Searching for new ideas	Zollo and Winter (2002)
	Idea generation Capability	McKelvie/ Davidsson (2006)
	External observation and evaluation capability	Madsen (2010)
	Ability to access the isolated domains of knowledge and predict future technology trends	Hargadon (2002)
	Structuring	Sirmon et al. (2007)
	Internal Coordination and Integration Capacity	Teece et al. (1997)
	Related Routines/ Processes	**References**
	Gathering and processing information	Teece (1997)
	Responsiveness to market changes	Amit/ Schoemaker (1993)
	Responsiveness to customer needs	Day (2004)
	Identify market opportunities for reconfiguration	Zahra/George (2002)
	Environmental scanning	Denneels (2008)
	Processes to direct R&D and select new technologies	Teece (2007)
	Processes to tap supplier and competitor innovation	Teece (2007)
	Processes to tap developments in exogenous science	Teece (2007)
	Processes to Identify target market segments, changing customer needs, and customer innovation	Teece (2007)
	Willingness to adopt best practice (benchmarking)	Teece et al. (1997)
Learning Capacity	**Related Concepts**	**References**
	Learning Capacity	Pavlou/ El Sawy (2011)
	Knowledge Acquisition and Assimilation Capacity	Zahra and George (2002)
	Seizing Capabilities	Teece (2007)
	Learning Capacity (repetition and experience)	Teece et al. (1997)
	Internal resource renewal capability	Madsen (2010)
	External resource acquisition capability	Madsen (2010)
	Resource acquisition capabilities	Borch and Madsen (2007)
	Learning network capabilities	Borch and Madsen (2007)
	Acquiring and releasing resources	Eisenhardt/ Martin (2000)
	Structuring	Sirmon et al. (2007)
	Bridging and Learning	Hargadon (2002)
	Related Routines/ Processes	**References**
	Knowledge creation routines	Eisenhardt/Martin (2000)
	Knowledge brokering	Eisenhardt/ Martin (2000)
	Knowledge creation and absorption	Verona and Ravasi (2003)
	Integration of external competencies	Galunic and Rodan (1998)
	Obtaining new knowledge	Cohen and Levinthal (1990)
	Knowledge articulation	Zander and Kogut (1995)
	Gain and release of resources	Eisenhardt/ Martin (2000)
	Internal R&D	Zollo and Winter (2002)
	Seizing opportunities with learning	Teece (2007)
	Alliance and resource acquisition routines	Eisenhardt/ Martin (2000)
	Post-acquisition integration	Zollo and Winter (2002)

Integrating Capacity	**Related Concepts**	**References**
	Integrating Capacity	Pavlou and El Sawy (2011)
	Transformation Capacity (RACAP)	Zahra and George (2002)
	Transformational/ Reconfiguring Capabilities	Teece (2007)
	Reconfiguring internal resources	Eisenhardt/ Martin (2000)
	Internal Resource Reconfiguration Capability	Madsen (2010)
	Internal Resource Integration Capability	Madsen (2010)
	Architectural Competence	Henderson/Cockburn (1994)
	Combinative Capacity	Kogut and Zander (1992);
	Collaborative Capacity	Grant (1996)
	Bundling	Sirmon et al. (2007)
	Linking	Hargadon (2002)
	Related Routines/ Processes	**References**
	Patching (add, combine and split)	Brown/ Eisenhardt (1999)
	Analogical Reasoning	Hawass (2010)
	Creative new thinking	Henderson/Cockburn (1994)
	Executing a collective activity	Helfat and Peteraf (2003)
	Knowledge Reconfiguration	Verona and Ravasi (2003)
	Reconfiguring Market competencies	Rindova and Taylor (2002)
	Restructuring and re-engeniering	Zollo and Winter (2002)
	Knowledge integration	Verona and Ravasi (2003)
	Reconfiguration/Refinement/ Recombination	Galunic and Rodan (1998)
	Detecting Resource Recombinations	Iansiti and Clark (1994)
	Innovative problem-solving	Van den Bosch et al. (1999)
	Pursuing new initiatives	Grant (1996)
	Revamping operational capabilities	Teece (2007)
	Reconfiguring/ Restructuring	Teece et al. (1997)
	Integrating resources	Eisenhardt/ Martin (2000)
Coordinating Capacity	**Related Concepts**	**References**
	Coordinating Capacity	Pavlou and El Sawy (2011)
	Exploitation Capacity (RACAP)	Zahra and George (2002)
	Reconfiguring internal resources	Eisenhardt/ Martin (2000)
	Transformational/ Reconfiguring Capabilities	Teece (2007)
	Reconfiguring/ Restructuring	Teece et al. (1997)
	Leveraging	Sirmon et al. (2007)
	Building	Hargadon (2002)
	Routinisation	Zollo and Winter (2002)
	Related Routines/ Processes	**References**
	Resource allocation routines	Eisenhardt/ Martin (2000),
	Appointing the right person to the right task	Eisenhardt/ Brown (1999)
	Identifying complementarities and synergies	Eisenhardt/ Galunic (2000)
	Orchestrating collective activities	Henderson (1994)
	Synchronise their tasks and activities	Helfat and Peteraf (2003)
	Exploitation Routines	Spender (1996)
	Leveraging of capabilities	Lichtenstein/ Brush (2001)
	Redeployment and reconfiguration	Capron et al. (1998)
	Coordination of internal and external activities	Teece (1997)
	Asset orchestration processes	Helfat/ Peteraf, 2009
	Restructuring re-engineering	Zollo and Winter (2002)

Appendix 3.2 Detailed Hypotheses for Entrepreneurial Orientation and Dynamic Capabilities

The firm's EO is proposed to affect the firms Sensing, Learning, Integrating and Coordinating capacities in ways as described in the following.

A high EO is proposed to positively affect the firm`s **Sensing capacity** as it promotes an outward focus on new opportunities in the environment (Wiklund et al., 2002), which is suggested to be positively associated with the firm`s Sensing capacity. According to Shane and Venkataraman (2000), the firm`s EO reveals the priority that firms place on the process of identifying and exploiting new opportunities in the market environment, as a result it becomes evident that firms with a higher EO, will most likely develop a high Sensing capacity over time. The firm`s Sensing capacity comprises activities such as monitoring the environment, providing impulse to new ideas and discover new possibilities (Madsen, 2010), and will be positively affected by the firm`s willingness and attitude to be innovative, proactive, and to take risks (Miller, 1983) in the following ways:

First, a high *innovativeness*, regarded as the firm`s orientation towards innovation and its general openness to new ideas, will facilitate the search and perception of new technologies, changing customer requirements and new developments in the market, and therefore positively affects the firm`s Sensing capacity (Hitt and Ireland, 2000). Second, a high *proactiveness* facilitated the firm`s ability to identify new opportunities in the environment, as it describes the firm`s general posture of anticipating and acting on future market needs and creating a first-mover advantage vis-a-vis competitors (Lumkin and Dess, 1996). Third, a positive attitude towards *risk-taking* moreover will foster the firm`s ability to spot, interpret and pursue opportunities in the internal and external environment through its inclination to handle uncertainty affiliated with addressing new opportunities in the environment (Teece et al., 1997). Consequently, a firm`s EO is proposed to positively influence the development of the firm`s Sensing capacity, leading to the following hypothesis:

H6a: *A high degree of Entrepreneurial Orientation is positively associated with the development of the firm`s Sensing capacity.*

A high EO is further proposed to positively affect the firm`s **Learning capacity** as the firm`s tendency or willingness to engage in, and support new ideas, novelty, experimentation will be positively associated with the adaption and creation of new knowledge, which basically constitutes a firm`s Learning capacity. Covin and Miles (2006) suggest in order to address new opportunities in the environment, firm`s with a high EO will be more prospective towards analysing and changing its own operational capacities in order to facilitate utilising and exploiting market opportunities. Accumulating and learning new knowledge hence is positively affected by the firm`s willingness to be innovative, proactive and engage in risk-taking behaviour (Lumkin and Dess, 1996).

First, *innovativeness*, as it captures the firm`s willingness and attitude to engage in, and support new ideas, novelty, experimentation, and creative processes, also concerns the adoption of new technology and knowledge, and revamp internal processes and procedures (Lumpkin and Dess, 1996), and thus will be positively associated to developing higher Learning capacity. Second, *proactiveness* is encouraging 'Learning', as individuals engaged in learning activities need to be open for internalising new knowledge and be proactive in articulating and sharing insights, intuitions, and tacit knowledge (Zollo and Winter, 2002). Third, *risk-taking* encompasses a positive attitude towards committing sufficiently time and resources to projects with uncertain outcomes. As such typically activities concerning the acquisition, assimilating and creation of new knowledge can be regarded, hence a positive attitude towards risk-taking, is suggested to be positively related to Learning.

Taken together, EO - regarded as a combination of innovativeness, proactiveness, and risk-taking - supports the development of Learning capacity, leading to the following hypothesis:

H6b: *A high degree of Entrepreneurial Orientation is positively associated with the development of the firm`s Learning capacity.*

Besides its influence on Sensing and Learning capacity, a high EO is proposed to positively affect the firm`s **Integrating capacity.** This can be deduced to the perception that as a high EO promotes thinking new ways and restraining from the old, it is suggested to be positively associated with the firm`s Integrating capacity. Following Wiklund and Shepherd (2003), the firm`s EO will be positively associated with how firms integrate new bundles of knowledge based resources to develop new products and services. Similarly, Wiklund et al. (2002) confirmed that by encouraging new ideas, experimentation and creativity in firms (e.g. Covin and Slevin, 1991), firms that have created an entrepreneurial culture are more likely to come up with creative ideas for how to best reconfigure and refine their resources in order to adjust its resource base to new opportunities in the environment. A firm`s EO, its willingness to be innovative, proactive and engage in risk-taking behaviour, thus is suggested to be positively associated with the development of the firm`s Integrating capacity in the following ways:

First, *innovativeness* is closely linked to creativity (Scott, 1965) and represents a strong tendency to introduce novel, innovative or creative solutions (Whiting, 1988). A firms EO thus encourages firms to connect divergent ideas (Leonard and Sensiper, 1998), see new connections of existing resources (Zahra and Wiklund, 2002), and envisioning new combinations (Zahra and Wiklund, 2002). Second, equipped with a high *proactiveness* entrepreneurial firms will foster the intention to develop and explore ideas for innovative RCs, promote a cooperative spirit, and encourage a greater under-standing among team members (Zahra and Wiklund, 2002). For this reasoning, a high proactiveness is positively associated with the firm`s Integrating capacity. Third, as the combination of resources into new bundles generally involves uncertainty and the value of the resources is typically not recognised until they are being integrated (Denrell et al., 2003, Moran and Ghoshal, 1999, Wiklund and Shepherd, 2009), the firm`s willingness to take risks is positively related to Integrating capacity. Hence, a firm`s EO supports the development of Integrating capacity, leading to the following hypothesis:

H6c: *A high degree of Entrepreneurial Orientation is positively associated with the development of the firm`s Integrating capacity.*

Lastly, a high EO is proposed to positively affect the firm`s **Coordinating capacity**, because a high EO promotes a culture within the organisation where entrepreneurial activities are fostered (e.g. Brown et al., 2001, Covin and Slevin, 1991). A firm`s EO, thus its willingness to be innovative, proactive and engage in risk-taking behaviour, is suggested to be positively associated with the development of the firm`s Coordinating capacity in the following ways:

First, following Hamel and Prahalad (1994) within entrepreneurial oriented firms special emphasis is given on stretching the use of available resources over a wide range of areas and leveraging resources in new ways to develop new applications and create new products and services (Zahra and Wiklund, 2002). Second, following Stevenson (1983) entrepreneurial firms are typically organised with multiple informal networks, hence an entrepreneurial oriented management structure allows to easily access resources within the firm or through informal collaborative network relationships (Wiklund et al. 2002), which in turn facilitates the coordination and orchestration of resources into new productive resource bundles. This is in line with Teece et al. (2007, p. 1323) proposing that "more decentralized organizations with greater local autonomy are less likely to be blindsided by market and technological developments" and therefore are more likely to allocate the resources in appropriate ways to create value (e.g. Pavlou and El Sawy, 2011, Sirmon et al., 2007). Third, given such an environment where people have the flexibility to pursue new opportunities and can easily access resources to address new opportunities, is suggested to positively enhance the firm`s ability to orchestrate and deploy tasks, resources, and activities in the new operational capabilities in order to implement the new, innovative products or services (RRs) in the market. Consequently, a firm`s EO is proposed to support the development of the firm`s Coordinating capacity, leading to the following hypothesis:

H6d: *A high degree of Entrepreneurial Orientation is positively associated with the development of the firm`s Coordinating capacity.*

Appendix 3.3 Detailed Hypotheses for Networking Orientation and Dynamic Capabilities

The firm's NO is proposed to affect the firms Sensing, Learning, Integrating and Coordinating capacities in ways as described in the following.

A high NO is suggested to be positively associated with the firm`s **Sensing capacity** as the firm`s openness towards collaborating with external partners is found to positively affect the firm`s awareness of external opportunities (Isobe at al., 2008). This is corresponding with Teece (2007, p. 1322) who notes that "to identify and shape opportunities, enterprises must constantly scan, search, and explore across technologies and markets, both 'local' and 'distant'". Accordingly, a high degree of NO can help firms to identify new, external opportunities for the following reasoning:

First, by induced collaboration with external partners firms can obtain unique sources of information about untapped opportunities in the environment (Mu and Di Benedetto, 2012). Second, increased interaction with external partners enhances the firm`s opportunity-sharing facilities and information-processing channels, enabling firms to be more perceptive and responsive to dynamic changing environments and emergent opportunities (Mu and Di Benedetto, 2012). Third, the exploration of existing and new network ties, allows firms to develop a mutual understanding and awareness of resources available at different prices in the market and also to discover new, yet unknown resources (Mu and Di Benedetto, 2012). Hence, having information about the accessibility of appropriate resources at appropriate prices will enhance the firm`s ability to exploit these new opportunities (Shane and Venkataraman, 2000).

Summarising, the above arguments imply that highly developed external network ties can help to provide firms with useful information about technological breakthroughs and trajectories, capture new insights to existing problems, expose failure and success of current research activities, and thus can help firms to validate their prognoses about future technological and market trends and purposefully adapt the current business activities to these newly discovered opportunities (Mu and Di Benedetto, 2012). Consequently, a firm`s NO is supporting the development of a high Sensing capacity, leading to the following hypothesis:

H7a: *A higher degree of Networking Orientation is positively associated with the development of a firm`s Sensing capacity.*

Furthermore, a high NO is proposed to positively affect the firm`s **Learning capacity** as the firm`s tendency to collaborate with external network partners will be positively associated with the adaption and creation of new knowledge, which basically constitutes firm`s Learning capacity. Accordingly, if a firm is open to find, build and coordinate new network relationships, it generally facilitates the absorption of external knowledge (Cohen and Levinthal, 1990) and the generation of new knowledge (Rothaermel and Hess, 2007) for the following reasoning:

First, for the *absorption of external knowledge* firms are constrained to interact with network partners to obtain access to the necessary external resources to be acquired in a subsequent step, and used in order to develop new products or services (Lee et al., 2001). Accordingly, by drawing on the benefits of their network relations, firms are found to have information advantages by knowing whom to ask for obtaining the appropriate resources, but also by possessing superior knowledge about new resources ex ante, which allows a more accurate differentiation of those value-enhancing against value-destroying resources. This permits a correct evaluation of resources of interest and is subsequently leading to the acquisition of the 'winning' resources from the networks (Mu and Di Benedetto, 2012). Accordingly, a high NO is suggested to facilitate the acquisition of new knowledge by connecting network resources and activities. Moreover researchers have argued for transactional intensive firms to have a higher ability to integrate and learn knowledge that resides both inside and outside the firm`s boundaries (Lorenzoni and Lipparini, 1999). In their empirical study Mu and Di Benedetto (2002) moreover confirmed that resource acquisition (part of Learning capacity) partially mediates the positive relationship between networking capability and NPD performance.

Second, the *creation of new knowledge*, which comprises the routines of knowledge articulation and internalisation, is positively affected by the firm`s NO. As the reciprocal exchange, interaction and knowledge transfer among network partners not only enhances the firm`s ability to obtain, articulate, and exchange rich, fine-grained and tacit knowledge (Gulati, 1999, McEvily and Zaheer, 1999), which would be more expensive or not even accessible at all for firm`s lacking external network ties (Uzzi, 1997), it moreover ensures a high level of accuracy, reliability and quality of the knowledge exchanged, which in term allows generating a deeper understanding of technologies, innovations, and markets and thus facilitates the *internalisation* of knowledge gained from external sources (Mu and Di Benedetto, 2012). Confirming these arguments, Mu and Di Benedetto (2012) could give empirical evidence that both Market Knowledge generation and Technological Knowledge generation mediate the positive relationship between networking capability and NPD performance. Consistent with these findings, Powell et al. (1996) confirmed that knowledge creation processes incorporating external linkages by means of interfirm collaborations lead to superior technological development and thus firm performance (Isobe at al., 2008).

Based on these arguments, NO can help firms to access external knowledge sources, which are important for the adoption and generation of new knowledge. Consequently, a firm`s NO is regarded to support the development of a firm`s Learning capacity, leading to the following hypothesis:

H7b: *A higher degree of Networking Orientation is positively associated with the development of a firm`s Learning capacity.*

Besides its influence on the firm`s Sensing and Learning capacity, a high NO is proposed to positively affect the firm`s **Integrating capacity** as the firm`s openness to external entities will be positively associated with the firm's ability to creatively combine, integrate and transform disparate resources to form new operational capabilities. Hence, a high NO is proposed to facilitate the three underlying routines of Integrating capacity, namely (1) *transforming individual to collective knowledge*, (2) *inter-relating different knowledge domains*, and (3) *reconfiguration and refinement*, in the following ways:

First, a critical and regular feedback and knowledge exchange process throughout the network is supposed to provide the firm with a more comprehensive, rigorous, and unbiased appraisal of opportunities and thus facilitates the development of a collective knowledge (Mu and Di Benedetto, 2012). This can best be explained as "the scope and quality of information enables the firm in the network to process information in composite chunks rather than disparate pieces, elevating its cognitive capacity from those of bounded rationality to expert rationality" (Mu and Di Benedetto, 2012, p. 8).

Second, as the development of new RRs is found to be more effective when people from different disciplines interact (De Luca and Atuahene-Gima, 2007) and when otherwise isolated domains of knowledge are interrelated (Hawass, 2010, Hargadon, 1998), this processes require heterogeneity of knowledge inputs, and as such also require heterogeneity of actors (Mu and Di Benedetto, 2012). A high NO enables firms to search for, manage, and coordinate multiple network ties with external partners, which can provide access to specialised knowledge widely dispersed throughout the network members (Galunic and Rodan, 1998), and therewith facilitates to establish linkages between otherwise disconnected domains of knowledge, which in turn are supposed to facilitate firms to create more integrative solutions.

Third, because diverse inflows of new knowledge are proposed to strengthen assimilative abilities (Cohen and Levinthal, 1990) and analogical reasoning (Hawass, 2010, Hargadon, 1998), this facilitates the creative and effective recombinant search for novel associations (Helfat and Peteraf, 2003). This assumption is consistent with previous research finding confirming a strong positive effect of external learning through interfirm collaboration on reconfiguration and refinement capability (Isobe et al., 2008, Rothaermel, 2001, Lane and Lubatkin, 1998, Lee et al., 2001).

Hence, a strong NO is suggested to facilitate the firm`s ability to integrate and combine the diverse and multi-faceted knowledge inputs from external sources (Mu and Di Benedetto, 2012). Based on the above arguments, this research implies that a high NO is regarded to support the development of a firm`s Integrating capacity, leading to the following hypothesis:

H7c: *A higher degree of Networking Orientation is positively associated with the development of a firm`s Integrating capacity.*

Lastly, a high NO is proposed to positively affect the firm`s **Coordinating capacity**, as it facilitates the development of relevant skills for the internal orchestration of resources, which is suggested to be positively associated with the firm`s Coordinating capacity.

First, in accordance with Mu and Di Benedetto (2012, p. 8), this research suggests that "networking with other partners can enable the firm within a network to make sense of information and to classify it into perceptual categories, which help the firm to determine in what context the acquired information and knowledge can be put into use". Accordingly, it is suggested that firms, which are successful in finding, managing and coordinating its complex network relationships, will also develop the relevant skills for internally coordinating the resources more effective than its competitors (Nelson and Winter, 1982).

Second, NO warrants a high level of connectivity necessary for assembling resources in order to leverage the opportunities discovered by allowing the firm to mobilise and exploit the divergent resources of its network partners (Dyer and Singh, 1998, Mu and Di Benedetto, 2012). Consequently, if firms have the ability to identify and evaluate the value of appropriate knowledge residing at different points in the network and can orchestrate its transfer to where it is needed, then it can successfully promote knowledge creation and innovation (Gulati, 1998, Mu and Di Benedetto, 2012).

Third, research finding moreover revealed that, if firms are solely focussing on developing strong internal network ties without giving emphasis on the development of external network ties for accessing complementary knowledge and external sources of information, this can have a negative impact on innovation performance (e.g. Uzzi, 1997, Mu et al., 2008, Mu and Di Benedetto, 2011). This is due to the fact that firm`s with a high NO can easily access resources from the network in which it is embedded, and therefore can address possible constraints and prevent it from resource dependencies (Mu and Di Benedetto, 2012).

Hence, external resource orientation through networks is suggested to positively affect the internal coordination of knowledge and resources as it avoids giving an overemphasis on internal resources. On the other hand it may be proposed that a too strong orientation towards external resources by means of placing emphasis on developing external network ties may also negatively affect the coordination of internal abilities, as it may overshadow internal network ties. Nonetheless, as the previous arguments revealed, this research suggests a positive effect of NO on the development of the firm`s Coordinating capacity:

H7d: *A higher degree of Networking Orientation is positively associated with the development of a firm`s Coordinating capacity*

Appendix 4.1 Self Evaluation Questionnaire: Dynamic Capabilities of the Firm

Fachhochschule Münster University of Applied Sciences

Coventry University

ID: ___________________________
Company (optional): ___________________________
Industry (optional): ___________________________
Name (optional): ___________________________

Self Evaluation Questionnaire: Dynamic Capabilities of the Firm

This questionnaire measures the dynamic capabilities at the firm level. Please refer to the following statements to assess you firm`s dynamic capabilities. Scale: 1 = I strongly agree to 7 = I strongly disagree.	1	2	3	4	5	6	7

1. Sensing Capability	1	2	3	4	5	6	7
We frequently scan the environment to identify new business opportunities	☐	☐	☐	☐	☐	☐	☐
We periodically review the likely effect of changes in our business environment on customers	☐	☐	☐	☐	☐	☐	☐
We often review our product development efforts to ensure they are in line with what the customer want	☐	☐	☐	☐	☐	☐	☐
We have effective processes to tap developments in exogenous science and technology	☐	☐	☐	☐	☐	☐	☐
We have adequate processes to identify and respond to market or industry trends	☐	☐	☐	☐	☐	☐	☐
We have effective routines to monitor supplier and competitor activity	☐	☐	☐	☐	☐	☐	☐

2. Learning Capability	1	2	3	4	5	6	7
We have effective routines to identify, value, and import new information and knowledge	☐	☐	☐	☐	☐	☐	☐
We have adequate processes to renew our resource base by acquiring new external knowledge	☐	☐	☐	☐	☐	☐	☐
We have adequate processes to renew our resource base by releasing resources that became obsolete	☐	☐	☐	☐	☐	☐	☐
We have adequate routines to assimilate and understand new internal and external knowledge	☐	☐	☐	☐	☐	☐	☐
We have effective processes for knowledge codification (transferring tacit knowledge to explicit knowledge)	☐	☐	☐	☐	☐	☐	☐
We are effective in developing new knowledge that has the potential to influence product development	☐	☐	☐	☐	☐	☐	☐

3. Integrating Capability	1	2	3	4	5	6	7
We are forthcoming in contributing our individual knowledge to the group/ business unit	☐	☐	☐	☐	☐	☐	☐
We have a shared understanding of each other's tasks, responsibilities as well as knowledge and skills	☐	☐	☐	☐	☐	☐	☐
We are frequently executing collective, inter-departmental activities(e.g. cross functional teams, interdisciplinary teams, job-rotation practices)	☐	☐	☐	☐	☐	☐	☐
We are frequently executing collective, intra-departmental activities (e.g. regular team meetings, knowledge exchange, jour fixe)	☐	☐	☐	☐	☐	☐	☐
The members of different departments are well connected and frequently communicating with each other	☐	☐	☐	☐	☐	☐	☐
We have effective processes to create new product ideas by adapting and interconnecting knowledge and technologies from different industry sectors and domains (e.g. through analogical thinking, cross-innovation practices)	☐	☐	☐	☐	☐	☐	☐
We have effective routines for integrating and transforming existing resources and newly acquired resources into new innovative product ideas	☐	☐	☐	☐	☐	☐	☐

4. Coordinating Capability	1	2	3	4	5	6	7
We ensure an appropriate allocation of resources (e.g., information, time, money) within our group	☐	☐	☐	☐	☐	☐	☐
Group members are assigned to tasks corresponding to their task-relevant knowledge and skills	☐	☐	☐	☐	☐	☐	☐
We ensure that the output of our work is synchronized with the work of others	☐	☐	☐	☐	☐	☐	☐
We ensure that there is compatibility or synergy between group members expertise and work processes.	☐	☐	☐	☐	☐	☐	☐
We are efficient in leveraging our knowledge to implement and exploit new product ideas	☐	☐	☐	☐	☐	☐	☐

☐ I hereby agree that the above data can be analyzed by Kerstin Linnemann (for internal use only, with all data being kept confidential)

☐ I am willing to further contribute to this PhD research by making myself available for a personal interview (~ 20 minutes).

Please contact me, name: ___________________________

email: ___________________________

phone: ___________________________

Or simply replace the business card by your own → → → → →

Fachhochschule Münster University of Applied Sciences

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I would preferably be contacted:

☐ within the next two days in Istanbul. Please indicate time /location: ___________________________
☐ for a personal interview back in Germany
☐ for an interview via telephone/ skype

If you have any questions or concerns, please do not hesitate to contact me.

Thank you very much for supporting my PhD project!

Measurement items used in this questionnaire were in large parts adapted from the existing scale developed by Pavlou and El Sawy (2011), however also contained substantial contextual re-specifications and some additional items (more details on the scale development procedure are given in chapter 5.3.3). Therefore, it was deemed useful to pre-test the scales before being used in the quantitative survey. Additionally, empty textboxes have been included, asking for comments concerning the measurement items. Furthermore, the data gathered were statistically analysed in order to test the developed questionnaire on a small scale in regard to reliability and validity of measurement. This process followed standard scale development procedures.

Appendix 4.2 Characteristics of the Key Informants for the In-Depth Interviews

No.	Experience in RR activities	Position	Industry sector	Focus Area	Country(s) (Nationality)	Company size
# 1	high	CEO	IT Management Consultancy	Future Management, Innovation Management	Germany, South Africa, Turkey, Luxemburg	100
# 2	moderate	CEO	Strategy Consultancy	Change Management, Knowledge Management	Germany	3
# 3	high	Regional Manager	Business IT Management	Business Development, Resource Management	Ireland, + ca. 70 countries worldwide	5300
# 4	moderate	Consultant Innovation & Future Management	IT Management Consultancy	Future Management, Innovation Management	Germany, South Africa, Turkey, Luxemburg	100
# 5	moderate	CEO	Engineering and Product Development	Product Development	Germany	90
# 6	high	Managing Partner	ICT Management Consultancy	Capability Management, EAM	Germany. + 12 countries worldwide	1000

Appendix 4.3 Interview Guide for the In-Depth Interviews

Guide for in-depth face-to-face interviews with industrial representatives

Coventry University

Interviews conducted by Kerstin Linnemann for her PhD project entitled "Resource Recombination in Firms from a Dynamic Capability Perspective".

Background information on the interviewee:

Name:

Company:

Industy sector:

Position(s):

E-mail:

Phone:

Information about the interview:

Date:

Location:

Length:

Brief introduction of the project, covering:

- the definition of Resource Recombination / Dynamic Capabilities / Resources,

- an example (LEGO case, Cross Innovation),

- the aim of the project

1. Understanding the roles, activities and experiences of the interviewee:

Topic	Done	Notes
Strategic Orientation towards Resource Recombination (RR) › Does your company strategically foster RR activities?	□	
Kind of RR activity the interview is engaged in › What kind of RR activities have you been involved in (e.g. technological innovations, cross innovations, architectural innovations, R&D projects, NPD projects, M&A)? › Can you describe best practice examples of successful RRs within your company or your business environment?	□	
Role of the interviewee in these RR activities › Thinking about RR activities in general, what is your role in this process? What are your main activities and responsibilities?	□	
Who to interview in the quantitative study › Who else is engaged in RR activities? What Positions? Which Departments? › Are there also external entities engaged?	□	

Guide for in-depth face-to-face interviews with industrial representatives

2. Understanding the value of RR activities (broad perspective):

Topic	Done	Notes
Reasoning behind RR activities › Why is your organization fostering RR activities? What are the overall goals / objectives your company wants to achieve by recombining their resources? (e.g. competitive advantages, economic reasons, strategic reasons, innovations, short-term vs. long-term oriented)	□	
Evaluation of RR success › How would you define successful RR activities? › How do you measure successful RR activities?	□	

This PhD aims to develop a model for the likelihood of RR in firms. It is suggested that for the recombination of resources a firm has to posses both A) Dynamic Capabilities and B) a valuable Resource Base. (Short introduction of the LEGO-example)

3. Understanding the factors that drive Resource Recombination in firms

Topic	Done	Notes
A) DYNAMIC CAPABILITIES		
Dynamic capabilities (general) *Definition of Dynamic Capabilities to be presented* › When thinking about past RR projects, what are important capabilities / competences driving RR in firms? › Can you identify specific capabilities that enable you to recombine your resources in order to adapt to changing environments? If yes, which ones? › Can you identify different stages/ phases in the process of RR? Please explain. Are there specific capabilities related to each phase?	□	
Dynamic capabilities relevant for RR (specific DCs)		
1. Sensing Capacity *Definition of Sensing Capacity to be presented* › Do you frequently sense your environment for new opportunities? How would you evaluate your sensing capacity? › Do you have specific processes or routines for sensing, identifying and recognizing opportunities in the environment? › From your experience, what are the key drivers to successfully sense opportunities in the environment? › From your perception, how important is a high sensing capacity for generating new RRs?	□	

Guide for in-depth face-to-face interviews with industrial representatives

Coventry University

2. Learning Capacity □

Definition of Learning Capacity to be presented

- How would you evaluate your firms learning capacity?
- Do you have specific processes or routines that foster learning?
- From your experience, what are the key drivers to successfully internalize, absorb and assimilate new external and internal knowledge?
- From your perception, how important is a high learning capacity for generating new RRs?

3. Integrating Capacity □

Definition of Integrating Capacity to be presented

- How would you evaluate your firms integrating capacity?
- Do you have specific processes or routines that foster integration of existing and new knowledge into new resource bundles (e.g. RRs)?
- From your experience (in cross innovation), what are the key drivers to successfully integrate and combine knowledge into new innovative bundles?
- From your perception, how important is a high integrating capacity for generating new RRs?

4. Coordinating Capacity □

Definition of Coordinating Capacity to be presented

- How would you evaluate your firms coordinating capacity?
- Do you have specific processes or routines for the allocation of resources and orchestration of tasks?
- How do you ensure to get the right people to the right tasks? Do you have routines to implement and exploit the new product ideas?
- From your experience, what are the key drivers to successfully allocate your resources?
- From your perception, how important is a high coordinating capacity for generating new RRs?

Measurement Items for the DCs □

Questionnaire to be presented and discussed.

- Are all capacities well defined?
- Are all questions clear formulated?

Guide for in-depth face-to-face interviews with industrial representatives

Coventry University

B) CHARACTERISTICS OF THE RESOURCE BASE

Definition of Resource Base of the Firm and Hypotheses

Resource Endowments (general) □

- When thinking about past RR projects, what characteristics of the resource base are important for RR to occur?
- What characteristics might determine the potential value of the resources for RRs?
- If we transfer the LEGO example to your company, what would the "perfect" resource base for RR look like?

Resource Complementarity/Modularity (specific Characteristics) □

- In your company do you possess complementary resources? Please give examples?
- Is the modularization of resources (e.g. modular product parts) an important concept in your business?
- From your perception, what characterizes a high complementarity/ modularity of resources? How to measure it? (Measurement items)
- Would you suggest that a higher complementarity/ modularity of resources would lead to a higher amount of RRs? Why? Why not? (Relations)

Resource Flexibility □

- In your company do you possess high flexible resources?
- How would you evaluate the flexibility of your resources? (Measurement items)
- Would you suggest that a higher flexibility of resources leads to a higher amount of RRs? Why? Why not? (Relations)

Resource Heterogeneity/ Diversity □

- Do you possess highly diverse resources?
- In your company how would you measure the heterogeneity/ diversity of resources? (Measurement items: number of patents, patent classes, technologies, employees, departments etc.?)
- What would you suggest is the influence of the resource diversity on RRs? (Relations)

Resource Quality □

- In your company how do you evaluate the quality of your resources?
- From you perception, what determines a high quality of the resource base?
- How would you measure the quality of your resources? (Measurement items)
- What would you suggest is the influence of the resource quality on RRs? (Relations)

Guide for in-depth face-to-face interviews with industrial representatives

Coventry University

4. Understanding the role and effects of the specific DCs

Topic	Done	Notes

Model to be presented and discussed

Value Creation/ Potential Building (Exploration)
It is suggested that a firm`s sensing and learning capability is directed towards building the potential for RR (the "right" resource base) by exploring new resources and opportunities.

Value Realization (Exploitation)
It is suggested that a firm`s integrating and coordinating capability is directed towards realizing the value of the resource base by exploiting the resources and thereby to leverage the value creation potential of the resources.

- From your perception, does it make sense to differentiate between potential building and value realizing DCs? □
- Are the constructs clear and well defined?
- Is there anything missing?

5. Understanding the antecedents for the development of Dynamic Capabilities

Topic	Done	Notes

Entrepreneurial Orientation - Structure, Culture, Strategy □

- How do you evaluate the Entrepreneurial Orientation (EO) of your firm?
- From your experience, how important is an EO for the development of your firm`s DCs?
- What would you suggest is the influence of a high EO on the development of a firm`s DC? What influence does EO has on Sensing, Learning, Integrating, Coordinating Capacity? (Relations)

Interorganizational Collaboration/ Openness □

- How "open" is your firm?
  What networks, alliances, partnerships?
- From your experience, how important is the openness for the development of your firm`s DCs?
- What would you suggest is the influence of Openness on the development of a firms DC? What influence does openness has on Sensing, Learning, Integrating, Coordinating Capacity? (Relations)

THANK YOU FOR YOUR CONTRIBUTION!

Appendix 5.1 Measurement Items and Scales applied to measure each Construct

Sect.	Construct	Variable Name	Items Description	Scale	Source
O	**Demographics**				
	Current Position	V0100_Position	Your current position: (1) CEO / Managing Director / General Manager (2) C-Level Executive (e.g.CFO,CIO,COO) (3) Owner / Partner (4) Senior Manager (5) Middle Manager (6) Other, please specify [X]	nominal scale [X] Screened out	Own scale
	Functional Area	V0200_Function	Your (core) functional area: (1) General Management (2) Innovation Management (3) Product Development Management (4) Business Development Management (5) Research and Development (6) Other, please specify [X]	nominal scale [X] Screened out	Own scale
	Industry Sector	V0300_Ind_Sector	Industry Sector your firm is working in: (1) Agriculture, forestry and fishing (A) [X] (2) Mining and quarrying (B) [X] **(3) Manufacturing (C),** please specify: (4) Electricity, gas and water supply (D/E) [X] (5) Construction (F) [X] **(6) Wholesale and retail trade (G)** (7) Transportation and storage (H) [X] (8) Accomodation and food service activities (I) [X] **(9) Information and Communication (J)** **(10) Financial and insurance activities (K)** (11) Real Estate activities (L) [X] **(12) Professional, scientific & technical activities (M)** **(13) Administrative and support activities (N)** (14) Publix administration and defence (O) [X] (15) Education (P) [X] (16) Human Health and social work activities (Q) [X] (17) Arts, entertainment and recreation (R) [X] (18) Other service activities (S) [X] (19) Activities of private households as empl. (T) [X] (20) Activities of extraterritorial organizations and bodies (U) [X] (21) Other industry sector [X]	nominal scale *(UK Standard Industry Classification Scheme 2007 provided as a PDF-Document)* [X] Screened out	UK Standard Industry Classification Scheme 2007
	Number of Employees	V0400_CompSize	Number of employees: (1) <10 employees [X] (2) 10-50 employees (3) 51-250 employees (4) >250 employees	interval scale [X] Screened out	Isobe et al. (2008); Pavlou and El Sawy (2011); Wiklund et al. (2002)
	Ownership Structure	V0500_OwnerStruct	Ownerships Structure: (1) Public Company (listed on stock exchange) (2) Private company (ownerships by CEO and family) (3) Family-owned Company (ownerships by family) (4) Other, please specify	nominal scale	Zahra and Wiklund (2002); Wiklund et al. (2002)
	R&D Intensity	V0600_RDIntensity	Percentage of sales spent on R&D: (1) ---- (2) < 1 % (3) 1 % - 3 % (4) 3,01 % - 10 % (5) > 10 % (6) I don?t know	interval scale	Pavlou and El Sawy (2011)
	Company Age	V0700_CompAge	Company Age: Year in which your company was founded:	ratio scale	Isobe et al. (2008); Zahra et al. (2000)

Sect.	Construct	Variable Name	Items Description	Scale	Source
A	**Dynamic Capabilities**	**Introduction:** *The following section targets to measure your Dynamic Capabilities at the firm level. Therefore we ask you to rate your firm`s capacities in different areas relative to your major competitors. Please indicate for each statement the extent to which it describes your firm.*			
A	Sensing Capacity	V0801_Sensing	We frequently scan the environment to identify new business opportunities.	Seven-point likert scale	Pavlou and El Sawy (2011)
		V0802_Sensing	We periodically review the likely effect of changes in our business environment on customers.	1 = I strongly disagree 7 = I strongly agree	
		V0803_Sensing	We often review our product development efforts to ensure they are in line with what customers want.		
		V0804_Sensing	We have effective processes to tap developments in external science and technology.[1]		
		V0805_Sensing	We have adequate processes to identify and respond to industry trends.[1]		[1] item added to the original scale, the new item is based on Teece (2007)
		V0806_Sensing	We have effective routines to monitor competitor activity.[1]		
A	Learning Capacity	V0901_Learning	We have effective routines to identify, value and import new information and knowledge.	Seven-point likert scale	Pavlou and El Sawy (2011)
		V0902_Learning	We ensure a constant renewal of our resource base by acquiring new external knowledge and resources.[2]	1 = I strongly disagree 7 = I strongly agree	
		V0903_Learning	We have adequate routines to assimilate new information and knowledge.		
		V0904_Learning	We have adequate knowledge management processes to capture existing resources and knowledge available in the firm.[2]		
		V0905_Learning	We have adequate processes to renew our resource base by releasing resources that became obsolete.[2]		[2] item added to the original scale, the new item is based on Lichtenthaler (2009)
		V0906_Learning	We are effective in developing new knowledge that has the potential to influence product development.		
A	Integrating Capacity	V1001_Integrating	We are forthcoming in contributing our individual knowledge to the business unit.	Seven-point likert scale	Pavlou and El Sawy (2011)
		V1002_Integrating	We have a shared understanding of each other's tasks, responsibilities as well as knowledge and skills.	1 = I strongly disagree 7 = I strongly agree	
		V1003_Integrating	The members of different departments are well connected and frequently communicating with each other.[3]		
		V1004_Integrating	We frequently execute collective, intra-departmental activities (e.g. regular team meetings, knowledge exchange, jour fixe).[3]		
		V1005_Integrating	We frequently execute collective, inter-departmental activities (e.g. cross functional teams, interdisciplinary teams, job-rotation).[3]		[3] item added to the original scale, the new item is based on Menon (1997), Jarworski and Kohli (1994), Morgan and Piercy (1998)
		V1006_Integrating	We have effective processes to adapt and interconnect knowledge and technologies from different industry sectors and knowledge domains.[3]		
A	Coordinating Capacity	V1101_Coordinating	We ensure an appropriate allocation of resources (e.g. information, time, money) within our business unit.	Seven-point likert scale	Pavlou and El Sawy (2011)
		V1102_Coordinating	Group members are assigned to tasks corres-ponding to their task-relevant knowledge and skills.	1 = I strongly disagree 7 = I strongly agree	
		V1103_Coordinating	We ensure that the output of our work is synchronised with the work of others.		
		V1104_Coordinating	We ensure that there is compatibility or synergy between group members expertise and work processes.		
		V1105_Coordinating	We are efficient in leveraging our resources and knowledge to implement and exploit new product ideas.[4]		[4] item added to the original scale, the new item is based on Teece (2007)
		V1106_Coordinating	Overall, our business unit is well coordinated.		

Sect.	Construct	Variable Name	Items Description	Scale	Source
B	**Characteristics of the Resource Base**	**Introduction:** *Now we are interested in your firm`s knowledge-based resources, particularly your Market and Technological knowledge:* *Market knowledge refers to the firm's understanding of the market environment, particularly of customers and competitors. Technological knowledge refers to the firm`s technological expertise, R&D as well as engineering skills and competences. Please refer to the following characteristics of your firm`s Market and Technological knowledge.*			
B	Knowledge Breadth *= Number or range of different knowledge areas your firm is familiar with*	V1201_BreadthMarket1	Compared to our major competitors our Market knowledge is *narrow* vs. *broad*	Seven-point semantic differential scales (anchoring points in italics)	De Luca and Atuahene-Gima (2007); original scale by Zahra, Ireland and Hitt (2000)
		V1202_BreadthMarket2	Compared to our major competitors our Market knowledge is *limited vs. wide ranging*		
		V1203_BreadthTech1	Compared to our major competitors our Technological knowledge is *narrow* vs. *broad*		
		V1204_BreadthTech2	Compared to our major competitors our Technological knowledge is *limited* vs.*wide ranging*		
B	Knowledge Depth *= Level of sophistica-tion and complexity of your firm`s knowledge in a specific area*	V1301_DepthMarket1	Compared to our major competitors our Market knowledge is *shallow* vs. *deep*	Seven-point semantic differential scales (anchoring points in italics)	De Luca and Atuahene-Gima (2007); original scale by Zahra, Ireland and Hitt (2000)
		V1302_DepthMarket2	Compared to our major competitors our Market knowledge is *basic* vs. *advanced*		
		V1303_DepthTech1	Compared to our major competitors our Technological knowledge is *shallow* vs. *deep*		
		V1304_DepthTech2	Compared to our major competitors our Technological knowledge is *basic* vs. *advanced*		
B	Knowledge Origin	V1400_KnowOrigin	How much of your knowledge is internally based (EXISTING)* and how much is externally acquired (NEW)**? **Internally based (Existing) refers to knowledge that has already been existent for a long time in your firm.* ***Externally acquired (New) refers to knowledge that is new to the firm and has recently been acquired from external sources.*	Interval Scale Existing vs. New 100 % / 0 % 90 % / 10 % 80 % / 20 % 70 % / 30 % 60 % / 40 % 50 % / 50 % 40 % / 60 % 30 % / 70 % 20 % / 80 % 10 % / 90 % 0 % / 100 %	Own scale development
B	Knowledge Tacitness	V1501_KnowTacit	Our knowledge is difficult to comprehensively document in manuals or reports.	Seven-point likert scale 1 = I strongly disagree 7 = I strongly agree	De Luca and Atuahene-Gima (2007); original scale by Szulanski (1996)
		V1502_KnowTacit	Our knowledge is difficult to comprehensively understand from written documents.		
		V1503_KnowTacit	Our knowledge is difficult to identify without personal experience in using them.		
		V1504_KnowTacit	Our knowledge is difficult to precisely communicate through written documents.		
B	Knowledge Specificity	V1601_KnowSpeci	Our market and technological knowledge is quite specific to our kind of business.	Seven-point likert scale 1 = I strongly disagree 7 = I strongly agree	De Luca and Atuahene-Gima (2007); original scale by Reed and De Fillippi (1990)
		V1602_KnowSpeci	It would be very difficult for an employee to transfer knowledge obtained in our firm to other business environments.		
		V1603_KnowSpeci	Our knowledge and skills are tailored to meet the specific conditions of our business.		
		V1604_KnowSpeci	Our knowledge is very general and can easily be adopted to other businesses.[R]	[R] = reverse coded	
B	Knowledge Complementarity	V1701_KnowCompl	The market and technological knowledge we possess complement each other.	Seven-point likert scale 1 = I strongly disagree 7 = I strongly agree	Own scale development
		V1702_KnowCompl	The technology areas we are acting in are complementary to each other.		
		V1703_KnowCompl	The resources acquired are complementary to the existing ones.		

Sect.	Construct	Variable Name	Items Description	Scale	Source
C	**Resource Recombination**	**Introduction:** *Often innovation is seen as the recombination of resources in new ways to create new, innovative products or services. We differentiate between* ***4 types of Resource Recombination*** *according to their usage of EXISTING vs. NEW RESOURCES for ONGOING vs. NEW BUSINESS INITIATIVES.* *The following questions ask you to what extent your company focused on different types of Resource Recombination over the past 3 years and compared to the common practice in your industry.* ---------- *Definitions:* *- EXISTING Resources refer to internal resources that have already been existent for a long time in your firm.* *- NEW Resources refer to external resources that have recently been acquired.* ---------- *Pease indicate your agreement with the following statements with respect to the 4 different Types of Resource Recombination.*			
C	Resource Recombination in General	V1810_RR_Type1	In our firm innovation happens by recombining existing resources for ongoing business activities	Seven-point likert scale	Own scale development
		V1820_RR_Type2	In our firm innovation happens by recombining new resources for ongoing business activities	1 = I strongly disagree 7 = I strongly agree	
		V1830_RR_Type3	In our firm innovation happens by recombining existing resources for new business activities		
		V1840_RR_Type4	In our firm innovation happens by recombining new resources for new business activities		
C	Type 1: Existing Resources for Ongoing Activities	V1811_Type1	We changed the mix of existing resources used in current operations	Seven-point likert scale	Zahar and Wiklund (2000)
		V1812_Type1	We combined existing resources to upgrade our products or services	1 = I strongly disagree 7 = I strongly agree	
		V1813_Type1	We changed the mix of our existing resources to upgrade existing products or services		
		V1814_Type1	We reorganised our current operations to make more efficient use of our existing resources		
C	Type 2: New Resources for Ongoing Activities	V1821_Type2	We integrated new resources from other companies for use in current operations	Seven-point likert scale	Zahar and Wiklund (2000)
		V1822_Type2	We assembled new and existing resources and used them in current operations	1 = I strongly disagree 7 = I strongly agree	
		V1823_Type2	We acquired new resources to upgrade existing products or services		
		V1824_Type2	We combined new and existing resources to upgrade our existing products or services		
C	Type 3: Existing Resources for New Activities	V1831_Type3	We changed the mix of our existing resources to create radically new products or services	Seven-point likert scale	Zahar and Wiklund (2000)
		V1832_Type3	We bundled existing resources for use in new business initiatives	1 = I strongly disagree 7 = I strongly agree	
		V1833_Type3	We reorganised our existing assets to create new resources for use in new markets		
		V1834_Type3	We combined existing resources to develop new products for new markets		
C	Type 4: New Resources for New Activities	V1841_Type4	We bundled new with existing resources for use in new business initiatives	Seven-point likert scale	Zahar and Wiklund (2000)
		V1842_Type4	We integrated and transformed new and existing resources to develop new revenue sources	1 = I strongly disagree 7 = I strongly agree	
		V1843_Type4	We combined new and existing resources to develop new products or services		
		V1844_Type4	We coordinated the use of new resources in new business initiatives		
C	Overall Resource Recombination	V1901_OverallRR_1	We successfully reconfigure our resources to come up with new products or services.	Seven-point likert scale	Pavlou and El Sawy (2011)
		V1902_OverallRR_2	We often engage in Resource Recombination to better match our product-market areas and our resources.	1 = I strongly disagree 7 = I strongly agree	

Sect.	Construct	Variable Name	Items Description	Scale	Source
D	**Networking Orientation**	**Introduction:** *Please indicate for each statement the extent to which it describes your firm`s orientation towards collaborating with external partners (i.e. suppliers, customers, institutions).*			
		V2001_NetworkOrient	We search widely and actively to identify network partners.	Seven-point likert scale	Mu and Di Benedetto (2011)
		V2002_NetworkOrient	We know how to screen network partners.	1 = I strongly disagree 7 = I strongly agree	
		V2003_NetworkOrient	We assess and analyse our relationships with partners so that we know what adjustments to make.		
		V2004_NetworkOrient	We set up routines to manage our network relationships.		
		V2005_NetworkOrient	We make appropriate relationship-specific investments for the network development.		
		V2005_NetworkOrient	We assign competent personnel to manage the network relationships.		
E	**Environmental Turbulence**	**Introduction:** *Please indicate for each statement the extent to which it describes your firm`s market environment.*			
		V2101_EnvTurb	The actions of local and foreign competitors in our major markets are changing quite rapidly.	Seven-point likert scale	Atuahene-Gima (2005)
		V2102_ EnvTurb	Technological changes in our industry are rapid and unpredictable.	1 = I strongly disagree 7 = I strongly agree	
		V2103_ EnvTurb	The market competitive conditions are highly unpredictable.		
		V2104_ EnvTurb	Customer product preferences change quite rapidly.		
		V2105_ EnvTurb	Changes in customers' needs are unpredictable.		
F	**Innovation Performance**	**Introduction:** *Please indicate for each statement the extent to which it describes your firm`s innovation performance.*			
		V2201_InnoPerf	Innovative products or services do not provide a significant source of revenues for our firm.[R]	Seven-point likert scale	Marsh and Stock (2006)
		V2202_InnoPerf	Our firm develops better products or services than its competitors.	1 = I strongly disagree 7 = I strongly agree	
		V2203_InnoPerf	Our firm is more innovative than its competitors.		
		V2204_InnoPerf_Operati	Over time, we continually improve our product/ service development processes.		
		V2205_InnoPerf_Operati	Our operational processes are more efficient than that of our major competitors[5]		[5] item added to the scale, taken from Isobe, Makino and Montgomery (2008)
		V2206_InnoPerf_Operati	Our profitability is higher than that of our major competitors.[5]	[R] = reverse coded	
G	**Entrepreneurial Orientation**	**Introduction:** *In the last section pairs of statements are given, which represent opposite ends. Please mark the number which best represents the view of your firm.*			
		V2301_EntreOrient	(1) In general, the top managers of my firm favor… *… a strong emphasis on the marketing of tried and true products or services* vs. *… a strong emphasis on R&D, technological leadership and innovation.*	Seven-point semantic differential scales (anchoring points in italics)	Baker and Sinkula (2009); Naman and Stevin (1993)
		V2302_EntreOrient	(2) In general, the top managers of my firm have … *strong preference for low risk projects (with normal and certain rates of return)* vs. *... a strong preference for high risk projects (with chances of very high returns.*		
		V2303_EntreOrient	(3) In general,the top managers of my firm believe in … *gradual and cautious incremental behavior* vs. *… bold, wide ranging acts.*		
		V2304_EntreOrient	(4) When confronted with decision-making involving uncertainty, my firm … *… typically adopts a cautious, "wait and see" attitude to minimize the danger of making costly errors* vs. *… typically adopts a bold, aggressive attitude to maximize the potential of exploiting opportunities.*		
		V2305_EntreOrient	(5) How would you characterize changes in your product or service lines in the past five years? *Changes have been minor* vs. *Changes have been dramatic.*		
		V2306_EntreOrient	(6) In dealing with competitors my firm … … typically initiates actions to which competitors then respond. *… typically responds to actions which competitors initiate* vs. [R]	[R] = reverse coded	
		V2307_EntreOrient	(7) In dealing with competitors my firm … … is very often the first business to introduce new products and services. *… is very seldom the first business to introduce new products and services* vs. [R]		
		V2308_EntreOrient	(8) In dealing with competitors my firm … *… typically adopts a very competitive "undo the competitors" attitude.* *… typically seeks to avoid competitive clashes, preferring a "live and let live" attitude* vs. [R]		

Appendix 5.2 Final Questionnaire – Screenshots from the UNIPARK Online Survey Tool

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Industry Innovation Survey

8%

Dear participant,

First of all, many thanks for taking the time to support this crucial part of my PhD research at Coventry University.

Looking at **innovation generation in firms** this study aims to better understand how firms use their **resources** and **capabilities** to create competitive advantage. Doing so, this study can offer valuable insights into the source of variance in organisational performance outcomes. Your participation in the study will further give you the opportunity to reflect your own firm`s position against your competitors and to learn more about key success drivers; additionally we would like to offer you a summary of the study results.

Participation in the study is entirely voluntary; you can withdraw from the survey at any point of time, without giving reason and without implications for you. Please be assured that the **information you provide will remain strictly confidential and anonymous.** Answers will only be reported aggregated so that no individual or organisation will be identifiable from any publication presenting the results of the survey. By responding to the questionnaire, your consent to take part in the study is assumed. If you have any questions or would like to have further information about the study, please contact me (linnemak@uni.coventry.ac.uk) or my supervisor Dr. Gerry Urwin (G.Urwin@coventry.ac.uk) via email.

The survey should not take more than **15 minutes** of your time. **It is very important that you answer all questions,** even if some appear similar, to ensure reliable and valid measurement.

Thank you very much again for your time and your valuable contribution to my PhD research.

Yours sincerely,

Kerstin Linnemann

Final-year PhD candidate at Coventry University, UK

Dr. Gerry Urwin

Principal Lecturer in Business Strategy

and Supervisor of the PhD at Coventry Universtiy, UK

Continue

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Industry Innovation Survey

17%

Demographics

First of all, a few questions about yourself and your company.

Your current position

- ◯ CEO / Managing Director / General Manager
- ◯ C-level Executive (e.g. CFO, CIO, COO - excl. CEO)
- ◯ Owner/ Partner
- ◯ Senior Manager
- ◯ Middle Manager
- ◯ Other, please specify: ____________

Your (core) functional area

- ◯ General Management
- ◯ Innovation Management
- ◯ Product Development Management
- ◯ Business Development Management
- ◯ Research and Development
- ◯ Other, please specify: ____________

Industry sector your company is working in

Note: If you are unsure, please click on the following link to get further information on the UK Standard Industry Classification Scheme SIC-Codes.pdf

- ◯ Agriculture, forestry and fishing (A)
- ◯ Mining and quarrying (B)
- ◯ Manufacturing (C), please specify: ____________
  (you can either type in the name of your product segment or the 2-digit SIC Code (10-33) from the attached file SIC-Codes.pdf)
- ◯ Electricity, gas and water supply (D/ E)
- ◯ Construction (F)
- ◯ Wholesale and retail trade (G)
- ◯ Transport and storage (H)
- ◯ Accommodation and food service activities (I)
- ◯ Information and communication (J)
- ◯ Financial and insurance activities (K)
- ◯ Real estate activities (L)
- ◯ Professional, scientific and technical activities (M)
- ◯ Administrative and support service activities (N)
- ◯ Public administration and defence (O)
- ◯ Education (P)
- ◯ Human health and social work activities (Q)
- ◯ Arts, entertainment and recreation (R)
- ◯ Other service activities (S)
- ◯ Activities of private households as employers (T)
- ◯ Activities of extraterritorial organisations and bodies (U)
- ◯ Other, please specify: ____________

Number of employees

- ◯ < 10 employees
- ◯ 10-50 employees
- ◯ 51-250 employees
- ◯ > 250 employees

Ownership structure

- ◯ Public Company (listed on stock exchange)
- ◯ Private Company (ownership by CEO and family)
- ◯ Family-owned Company (ownership only by family)
- ◯ Other, please specify: ____________

R&D Intensity

Percentage of sales spent on R&D: --- *(Indicators: low-tech: ~less than 1%, medium-tech: ~1-3%; high-tech: ~10-15%)*

Company Age

Year in which your company was founded: ____________ (e.g. 1993)

Continue

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35%

A. Dynamic Capabilities of your Firm

The following section targets to measure your Dynamic Capabilities at the firm level. Therefore we ask you to rate your firm`s capacities in different areas relative to your major competitors.

Please indicate for each statement the extent to which it describes your firm.

Sensing Capacity

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We frequently scan the environment to identify new business opportunities.	○	○	○	○	○	○	○
We periodically review the likely effect of changes in our business environment on customers.	○	○	○	○	○	○	○
We often review our product development efforts to ensure they are in line with what customers want.	○	○	○	○	○	○	○
We have effective processes to tap developments in external science and technology.	○	○	○	○	○	○	○
We have adequate processes to identify and respond to market or industry trends.	○	○	○	○	○	○	○
We have effective routines to monitor competitor activity.	○	○	○	○	○	○	○

Learning Capacity

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We have effective routines to identify, value and import new information and knowledge.	○	○	○	○	○	○	○
We ensure a constant renewal of our resource base by acquiring new external knowledge and resources.	○	○	○	○	○	○	○
We have adequate routines to assimilate new information and knowledge.	○	○	○	○	○	○	○
We have adequate knowledge management processes to capture existing resources and knowledge available in the firm.	○	○	○	○	○	○	○
We have adequate processes to renew our resource base by releasing resources that become obsolete.	○	○	○	○	○	○	○
We are effective in developing new knowledge that has the potential to influence product development.	○	○	○	○	○	○	○

Integrating Capacity

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We are forthcoming in contributing our individual knowledge to the business unit.	○	○	○	○	○	○	○
We have a shared understanding of each other's tasks, responsibilities as well as knowledge and skills.	○	○	○	○	○	○	○
The members of different departments are well connected and frequently communicating with each other.	○	○	○	○	○	○	○
We frequently execute collective, intra-departmental activities (e.g. regular team meetings, knowledge exchange, jour fixe).	○	○	○	○	○	○	○
We frequently execute collective, inter-departmental activities (e.g. cross functional teams, interdisciplinary teams, job-rotation).	○	○	○	○	○	○	○
We have effective processes to adapt and interconnect knowledge and technologies from different industry sectors and knowledge domains.	○	○	○	○	○	○	○

Coordinating Capacity

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We ensure an appropriate allocation of resources (e.g. information, time, money) within our business unit.	○	○	○	○	○	○	○
Group members are assigned to tasks corresponding to their task-relevant knowledge and skills.	○	○	○	○	○	○	○
We ensure that the output of our work is synchronised with the work of others.	○	○	○	○	○	○	○
We ensure that there is compatibility or synergy between group members` expertise and work processes.	○	○	○	○	○	○	○
We are efficient in leveraging our resources and knowledge to implement and exploit new product ideas.	○	○	○	○	○	○	○
Overall, our business unit is well coordinated.	○	○	○	○	○	○	○

Many thanks for supporting this PhD research!

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Industry Innovation Survey

44%

B. Your Firm`s Resources

Now we are interested in your firm`s knowledge-based resources, particularly your Market and Technological knowledge:

- **Market knowledge** refers to the firm's understanding of the market environment, particularly of customers and competitors
- **Technological knowledge** refers to the firm's technological expertise, R&D as well as engineering skills and competences

Knowledge Breadth

= *Number or range of different knowledge areas your firm is familiar with*

Compared to our major competitors our Market knowledge is ...

narrow ○ ○ ○ ○ ○ ○ ○ broad

limited ○ ○ ○ ○ ○ ○ ○ wide ranging

Compared to our major competitors our Technological knowledge is ...

narrow ○ ○ ○ ○ ○ ○ ○ broad

limited ○ ○ ○ ○ ○ ○ ○ wide ranging

Knowledge Depth

= *Level of sophistication and complexity of your firm`s knowledge in a specific area*

Compared to our major competitors our Market knowledge is ...

shallow ○ ○ ○ ○ ○ ○ ○ deep

basic ○ ○ ○ ○ ○ ○ ○ advanced

Compared to our major competitors our Technological knowledge is ...

shallow ○ ○ ○ ○ ○ ○ ○ deep

basic ○ ○ ○ ○ ○ ○ ○ advanced

Knowledge Origin

How much of your knowledge is internally based (EXISTING) and how much is externally acquired (NEW)?

Internally based (EXISTING)* [100% / 0%] **Externally acquired (NEW)****

* *Internally based (EXISTING) refers to knowledge that has already been existent for a long time in your firm.*

** *Externally acquired (NEW) refers to knowledge that is new to the firm and has recently been acquired from external sources.*

Continue

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Industry Innovation Survey

54%

Knowlegde Tacitness, Specificy and Complementarity

Please indicate your agreement with each of the following statements with respect to your firm's market and technological knowledge.

Knowledge Tacitness

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
Our knowledge is difficult to comprehensively document in manuals or reports.	○	○	○	○	○	○	○
Our knowledge is difficult to comprehensively understand from written documents.	○	○	○	○	○	○	○
Our knowledge is difficult to identify without personal experience in using them.	○	○	○	○	○	○	○
Our knowledge is difficult to precisely communicate through written documents.	○	○	○	○	○	○	○

Knowledge Specificity

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
Our market and technological knowledge is quite specific to our kind of business.	○	○	○	○	○	○	○
It would be very difficult for an employee to transfer knowledge obtained in our firm to other business environments.	○	○	○	○	○	○	○
Our knowledge and skills are tailored to meet the specific conditions of our business.	○	○	○	○	○	○	○
Our knowledge is very general and can easily be adopted to other businesses.	○	○	○	○	○	○	○

Knowledge Complementarity

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
The market and technological knowledge we possess complement each other.	○	○	○	○	○	○	○
The technology areas we are acting in are complementary to each other.	○	○	○	○	○	○	○
The resources acquired are complementary to the existing ones.	○	○	○	○	○	○	○

Continue

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63%

C. Resource Recombination in Firms

Often innovation is seen as the recombination of resources in new ways to create innovative products or services.

We differentiate between **4 Types of Resource Recombination** according to their usage of
EXISTING or NEW Resources for **ONGOING or NEW Business Initiatives** .

The following questions ask you to what extent your company focused on different types of Resource Recombination over the past 3 years and compared to the common practice in your industry.

Definitions:

- **EXISTING** Resources refer to internal resources that have already been existent for a long time in your firm.
- **NEW** Resources refer to external resources that have recently been acquired.

4 Types of Resource Recombination

Please indicate your agreement with the following statements with respect to the 4 different Types of Resource Recombination.

In our firm innovation happens by recombining ...	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
existing resources for ongoing business activities (Type 1)	○	○	○	○	○	○	○
new resources for ongoing business activities (Type 2)	○	○	○	○	○	○	○
existing resources for new business activities (Type 3)	○	○	○	○	○	○	○
new resources for new business activities (Type 4)	○	○	○	○	○	○	○

Type 1: EXISTING Resources for ONGOING Business Initiatives

Now please refer to Type 1 in more detail.

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We changed the mix of existing resources used in current operations.	○	○	○	○	○	○	○
We combined existing resources to upgrade our products or services.	○	○	○	○	○	○	○
We changed the mix of our existing resources to upgrade existing products or services.	○	○	○	○	○	○	○
We reorganised our current operations to make more efficient use of our existing resources.	○	○	○	○	○	○	○

Type 2: NEW Resources for ONGOING Business Initiatives

Now please refer to Type 2 in more detail.

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We integrated new resources from other companies for use in current operations.	○	○	○	○	○	○	○
We assembled new and existing resources and used them in current operations.	○	○	○	○	○	○	○
We acquired new resources to upgrade existing products or services.	○	○	○	○	○	○	○
We combined new and existing resources to upgrade our products or services.	○	○	○	○	○	○	○

Type 3: EXISTING Resources for NEW Business Initiatives

Now please refer to Type 3 in more detail.

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We changed the mix of our existing resources to create radically new products or services.	○	○	○	○	○	○	○
We bundled existing resources for use in new business initiatives.	○	○	○	○	○	○	○
We reorganised our existing assets to create new resources for use in new markets.	○	○	○	○	○	○	○
We combined existing resources to develop new products for new markets.	○	○	○	○	○	○	○

Type 4: NEW Resources for NEW Business Initiatives

Now please refer to Type 4 in more detail.

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We bundled new with existing resources for use in new business initiatives.	○	○	○	○	○	○	○
We integrated and transformed new and existing resources to develop new revenue sources.	○	○	○	○	○	○	○
We combined new and existing resources to develop new products or services.	○	○	○	○	○	○	○
We coordinated the use of new resources in new business initiatives.	○	○	○	○	○	○	○

Overall Resource Recombination

Now please refer to Resource Recombination in general.

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We successfully reconfigure our resources to come up with new products or services.	○	○	○	○	○	○	○
We often engage in Resource Recombination to better match our product-market areas and our resources.	○	○	○	○	○	○	○

Continue

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72%

D. Networking Orientation

Please indicate for each statement the extent to which it describes your firm`s orientation towards collaborating with external partners (i.e. suppliers, customers, institutions).

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
We search widely and actively to identify network partners.	○	○	○	○	○	○	○
We know how to screen network partners.	○	○	○	○	○	○	○
We assess and analyse our relationships with partners so that we know what adjustments to make.	○	○	○	○	○	○	○
We set up routines to manage our network relationships.	○	○	○	○	○	○	○
We make appropriate relationship-specific investments for the network development.	○	○	○	○	○	○	○
We assign competent personnel to manage the network relationships.	○	○	○	○	○	○	○

E. Environmental Turbulence

Please indicate for each statement the extent to which it describes your firm`s market environment.

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
The actions of local and foreign competitors in our major markets are changing quite rapidly.	○	○	○	○	○	○	○
Technological changes in our industry are rapid and unpredictable.	○	○	○	○	○	○	○
The market competitive conditions are highly unpredictable.	○	○	○	○	○	○	○
Customer product preferences change quite rapidly.	○	○	○	○	○	○	○
Changes in customers' needs are unpredictable.	○	○	○	○	○	○	○

F. Innovation Performance

Please indicate for each statement the extent to which it describes your firm`s innovation performance

	I strongly disagree 1	2	3	4	5	6	I strongly agree 7
Innovative products or services do not provide a significant source of revenues for our firm.	○	○	○	○	○	○	○
Our firm develops better products or services than its competitors.	○	○	○	○	○	○	○
Our firm is more innovative than its competitors.	○	○	○	○	○	○	○
Over time, we continually improve our product/ service development processes.	○	○	○	○	○	○	○
Our operational processes are more efficient than those of our major competitors.	○	○	○	○	○	○	○
Our profitability is higher than that of our major competitors.	○	○	○	○	○	○	○

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81%

G. Entrepreneurial Orientation

*In this **last question** pairs of statements are given, which represent opposite ends. Please mark the number which best represents the view of your firm.*

(1) In general, the top managers of my firm favor...

... a strong emphasis on the marketing of tried and true products or services.	○	○	○	○	○	○	○	... a strong emphasis on R&D, technological leadership and innovation.

(2) In general, the top managers of my firm have ...

... a strong preference for low risk projects (with normal and certain rates of return).	○	○	○	○	○	○	○	... a strong preference for high risk projects (with chances of very high rates of return).

(3) In general, the top managers of my firm believe in ...

... gradual and cautious incremental behavior	○	○	○	○	○	○	○	... bold, wide ranging acts.

(4) When confronted with decision-making involving uncertainty, my firm ...

...typically adopts a cautious, "wait and see" attitude to minimise the danger of making costly errors.	○	○	○	○	○	○	○	... typically adopts a bold, aggressive attitude to maximise the potential of exploiting opportunities.

(5) How would you characterise changes in your product or service lines in the past five years?

Changes have been minor.	○	○	○	○	○	○	○	Changes have been dramatic.

(6) In dealing with competitors my firm ...

... typically initiates actions to which competitors then respond.	○	○	○	○	○	○	○	... typically responds to actions which competitors initiate.
... is very often the first business to introduce new products and services.	○	○	○	○	○	○	○	... is very seldom the first business to introduce new products and services.
... typically adopts a very competitive "undo the competitors" attitude.	○	○	○	○	○	○	○	... typically seeks to avoid competitive clashes, preferring a "live and let live" attitude.

Continue

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Industry Innovation Survey

100%

AGAIN, THANK YOU VERY MUCH FOR YOUR TIME AND PARTICIPATION !

If you would like to receive the results of the study, please send me an email (linnemak@uni.coventry.ac.uk) with the subject "survey results". This is to ensure that your email address will be saved separately to your survey answers.
A report will be send to you once the data has been analysed.

Appendix 5.3 TOP 15 Industries in Terms of Expenditure on R&D performed in UK Businesses by SIC Codes in 2011

Source: Office for National Statistics, 2011, p. 57

Appendix 5.4 Nonresponse Bias - Levene's Test for the Equality of Variances and the independent Samples t-Test

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Appendix 6.1 Results from the Kaiser-Meyer-Olkin measure and Bartlett Test of Sphericity

KMO- und Bartlett-test

Kaiser-Meyer-Olkin Measure		.898
Bartlett test of sphericity	Chi-squared	7722.022
	df	990
	Significance	0.000

Communalities

	Initial	Extraction
V0801_Sensing	1.000	.743
V0802_Sensing	1.000	.725
V0803_Sensing	1.000	.718
V0903_Learning	1.000	.811
V0904_Learning	1.000	.813
V0905_Learning	1.000	.802
V0906_Learning	1.000	.773
V1002_Integrating	1.000	.750
V1003_Integrating	1.000	.792
V1004_Integrating	1.000	.864
V1005_Integrating	1.000	.772
V1101_Coordinating	1.000	.744
V1103_Coordinating	1.000	.749
V1104_Coordinating	1.000	.799
V1201_BreadthMarket1	1.000	.772
V1202_BreadthMarket2	1.000	.827
V1301_DepthMarket1	1.000	.783
V1302_DepthMarket2	1.000	.788
V1203_BreadthTech1	1.000	.843
V1204_BreadthTech2	1.000	.863

Communalities

	Initial	Extraction
V1303_DepthTech1	1.000	.852
V1304_DepthTech2	1.000	.863
V1501_KnowTacit	1.000	.862
V1502_KnowTacit	1.000	.910
V1504_KnowTacit	1.000	.850
V1601_KnowSpeci	1.000	.764
V1602_KnowSpeci	1.000	.687
V1603_KnowSpeci	1.000	.748
V1701_KnowCompl	1.000	.801
V1702_KnowCompl	1.000	.867
V1703_KnowCompl	1.000	.795
V2001_NetworkOrient	1.000	.718
V2002_NetworkOrient	1.000	.803
V2003_NetworkOrient	1.000	.860
V2004_NetworkOrient	1.000	.819
V2005_NetworkOrient	1.000	.828
V2006_NetworkOrient	1.000	.769
V2103_EnvTurb	1.000	.719
V2104_EnvTurb	1.000	.753
V2105_EnvTurb	1.000	.819
V2302_EntreOrient	1.000	.807
V2303_EntreOrient	1.000	.793
V2304_EntreOrient	1.000	.738
V1102_Coordinating	1.000	.778
V1106_Coordinating	1.000	.822

Appendix 6.2 Factor Structure from the EFA

Pattern matrix[a]

	Sensing	Learning	Integra-ting	Coordi-nating	Techno Knowl	Market Knowl	Entre Orient	Netw Orient	Knowl Tacit	Knowl Compl	Knowl Speci	Env Turb
V0801_Sensing	.879											
V0803_Sensing	.755											
V0802_Sensing	.727											
V0905_Learning		.933										
V0904_Learning		.700										
V0903_Learning		.562										
V0906_Learning		.462										
V1004_Integrating			.905									
V1005_Integrating			.860									
V1003_Integrating			.739									
V1002_Integrating			.708									
V1102_Coordinating				.932								
V1103_Coordinating				.835								
V1104_Coordinating				.799								
V1101_Coordinating				.675								
V1106_Coordinating				.596								
V1304_DepthTech2					.941							
V1303_DepthTech1					.894							
V1204_BreadthTech2					.863							
V1203_BreadthTech1					.854							
V1201_BreadthMarket1						.860						
V1202_BreadthMarket2						.844						
V1301_DepthMarket1						.839						
V1302_DepthMarket2						.808						

Extraction method: PCA ; Rotation method: Promax with Kaiser Normalisation

Factor Structure from the EFA (Part 2)

Pattern matrix[a]

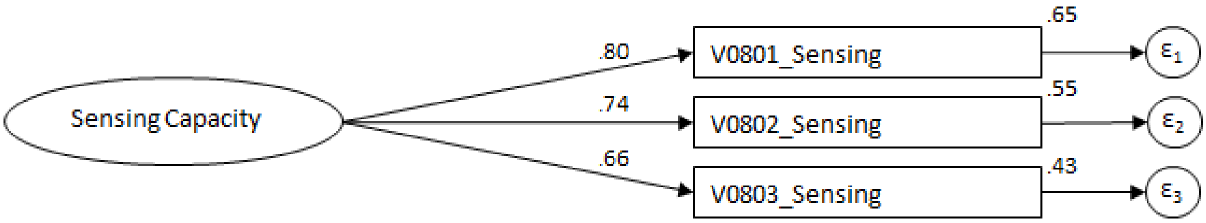
	Sensing	Learning	Integra-ting	Coordina-ting	Techno Knowl	Market Knowl	Entre Orient	Netw Orient	Knowl Tacit	Knowl Compl	Knowl Speci	Env Turb
V2302_EntreOrient							.905					
V2303_EntreOrient							.904					
V2304_EntreOrient							.760					
V2002_NetworkOrient								.900				
V2004_NetworkOrient								.873				
V2005_NetworkOrient								.873				
V2006_NetworkOrient								.863				
V2001_NetworkOrient								.853				
V2003_NetworkOrient								.824				
V1502_KnowTacit									.979			
V1501_KnowTacit									.929			
V1504_KnowTacit									.914			
V1702_KnowCompl										.941		
V1703_KnowCompl										.774		
V1701_KnowCompl										.764		
V1603_KnowSpeci											.866	
V1601_KnowSpeci											.825	
V1602_KnowSpeci											.427	
V2105_EnvTurb												.895
V2103_EnvTurb												.830
V2104_EnvTurb												.805

Extraction method: PCA ; Rotation method: Promax with Kaiser Normalisation

Appendix 6.3 One-Factor Congeneric Measurement Models

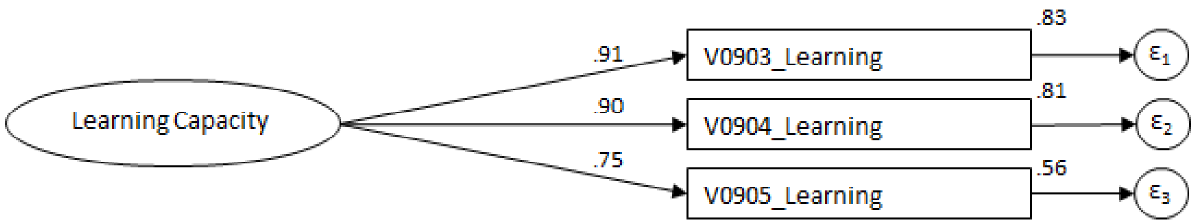
The final one-factor congeneric measurement models for each latent construct are presented below, along with their factor score weights and respective model fit indices. The coding refers to the items in the questionnaire as presented in Appendix 5.1.

Congeneric Measurement Model – Sensing Capacity



χ^2	1.039	χ^2/ df	1.039	TLI	.999	RMR	.026
Df	1	GFI	.997	CFI	1.000	RMSEA	.014
p - value	.308	AGFI	.980	NFI	.994	CAIC	32.727

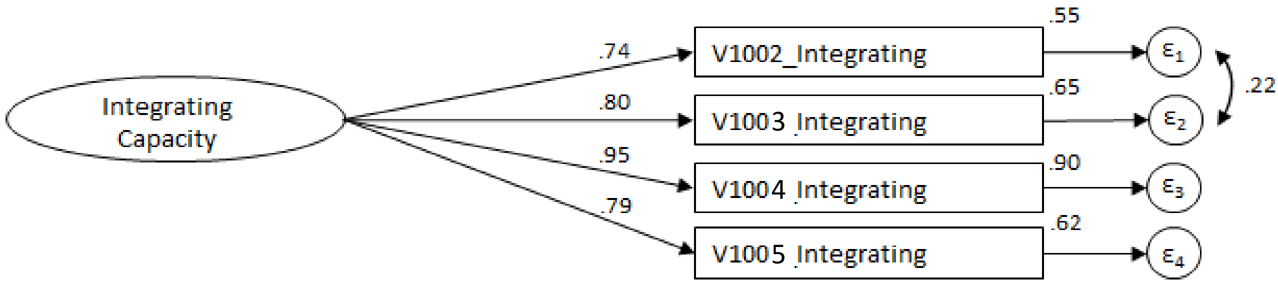
Congeneric Measurement Model – Learning Capacity



χ^2	1.292	χ^2/ df	1.292	TLI	.998	RMR	.017
df	1	GFI	.996	CFI	.999	RMSEA	.038
p - value	.256	AGFI	.975	NFI	.997	CAIC	32.980

The EFA results indicated to the application of four items to measure Learning capacity. However, the analysis of discriminant validity (as discussed in chapter 6.4.3) led to the elimination of the fourth item (V0906_Learning) in the final congeneric measurement model, due to its high correlation with other items used to measure Sensing capacity.

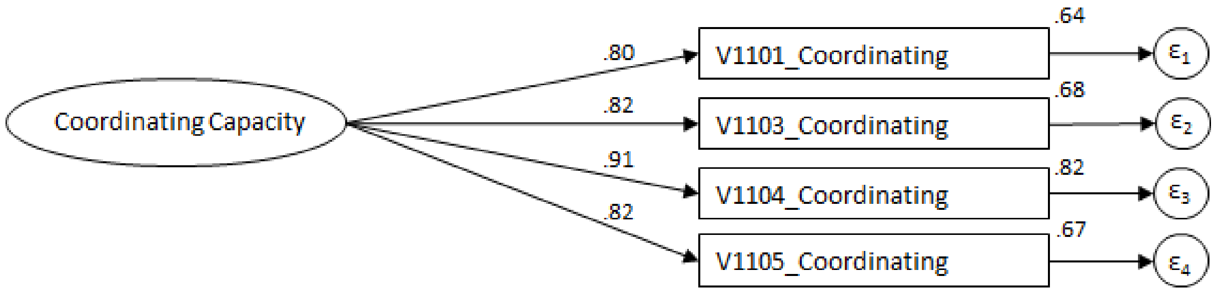
Congeneric Measurement Model – Integrating Capacity



χ^2	1.919	χ^2/ df	1.919	TLI	.989	RMR	.021
df	1	GFI	.995	CFI	.998	RMSEA	.067
p - value	.166	AGFI	.954	NFI	.996	CAIC	58.957

Following the analysis of modification indices, the error terms ε1 and ε2 were covaried in order to achieve a more parsimony model.

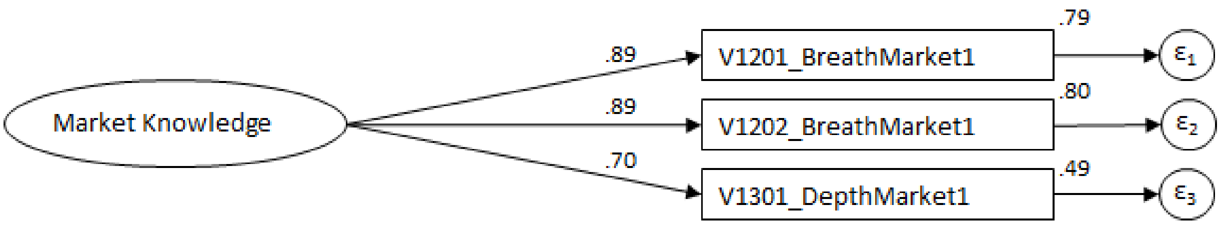
Congeneric Measurement Model – Coordinating Capacity



χ^2	1.424	χ^2/ df	.712	TLI	1.003	RMR	.014
df	2	GFI	.997	CFI	1.000	RMSEA	.000
p - value	.491	AGFI	.983	NFI	.997	CAIC	52.125

Notably, the best fitting and most parsimonious model derived from the CFA resulted in a different factor structure than that derived from the EFA. However, as all items showed high factor loadings, the model presented above qualified for further analysis.

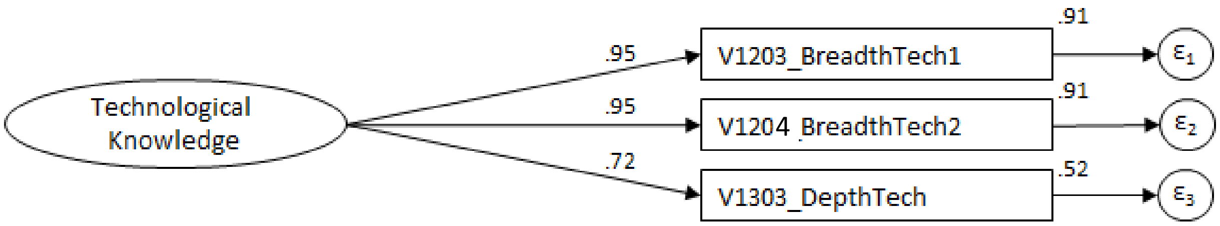
Congeneric Measurement Model – Market Knowledge



χ^2	.083	χ^2/ df	.083	TLI	1.008	RMR	.004
df	1	GFI	1.000	CFI	1.000	RMSEA	.000
p - value	.773	AGFI	.998	NFI	1.000	CAIC	31.771

Compared to the suggested factor structure resulting from the EFA, V1302_DepthMarket was eliminated from the congeneric measurement model as this lead to improved model fit.

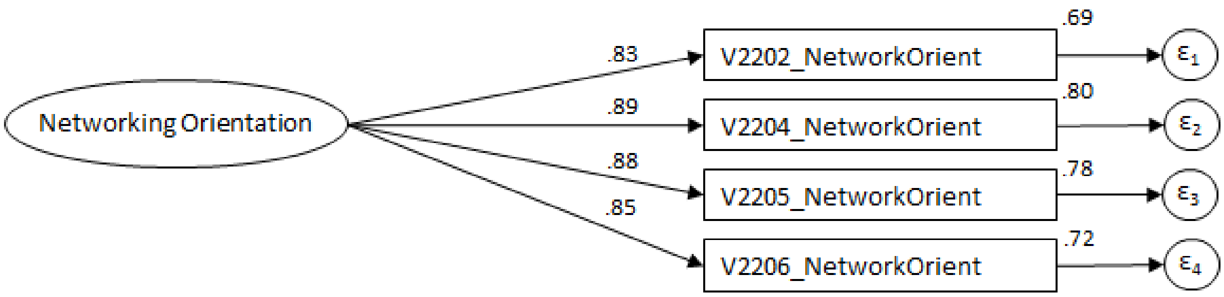
Congeneric Measurement Model – Technological Knowledge



χ^2	2.034	χ^2/ df	2.034	TLI	.994	RMR	.016
df	1	GFI	.994	CFI	.998	RMSEA	.071
p - value	.154	AGFI	.961	NFI	.996	CAIC	33.722

For similar reasons as mentioned above, V1304_TechnologyKnowledge was eliminated from the congeneric measurement model.

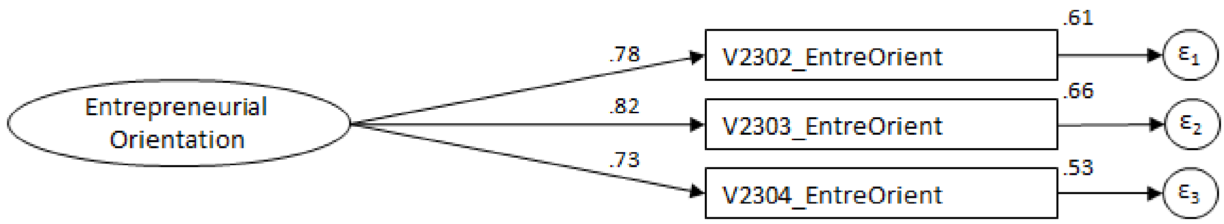
Congeneric Measurement Model – Networking Orientation



χ^2	.803	χ^2/ df	.402	TLI	1.006	RMR	.012
df	2	GFI	.998	CFI	1.000	RMSEA	.000
p - value	.669	AGFI	.990	NFI	.999	CAIC	51.503

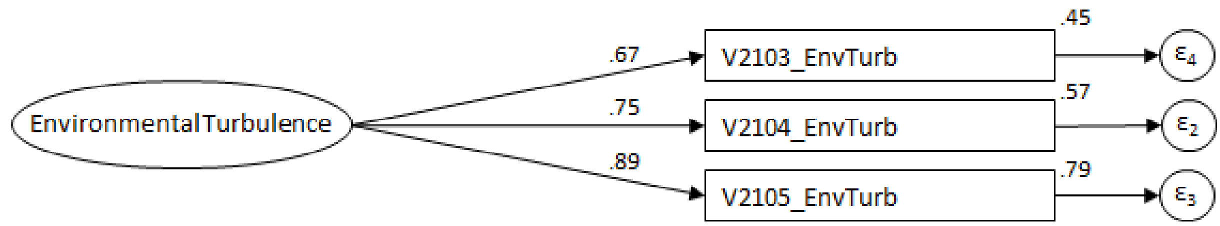
Balancing out content-wise and statistical aspects with the reasoning of achieving better model fit, V2201 and V2203, both expected to measure Networking Orientation were not included in the final congeneric model.

Congeneric Measurement Model – Entrepreneurial Orientation



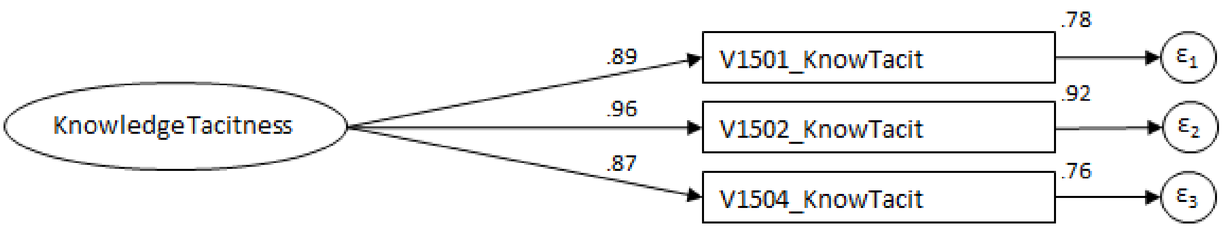
χ^2	.476	χ^2/ df	.476	TLI	1.007	RMR	.020
df	1	GFI	.998	CFI	1.000	RMSEA	.000
p - value	.490	AGFI	.991	NFI	.998	CAIC	32.164

Congeneric Measurement Model – Environmental Turbulence



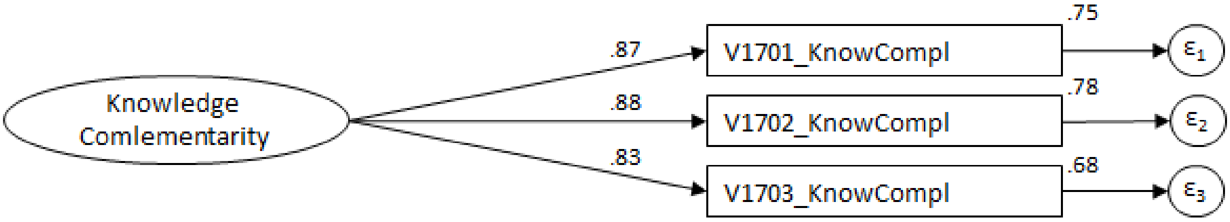
χ^2	.209	χ^2/ df	.209	TLI	1.011	RMR	.015
df	1	GFI	.999	CFI	1.000	RMSEA	.000
p - value	.648	AGFI	.996	NFI	.999	CAIC	31.897

Congeneric Measurement Model – Knowledge Tacitness



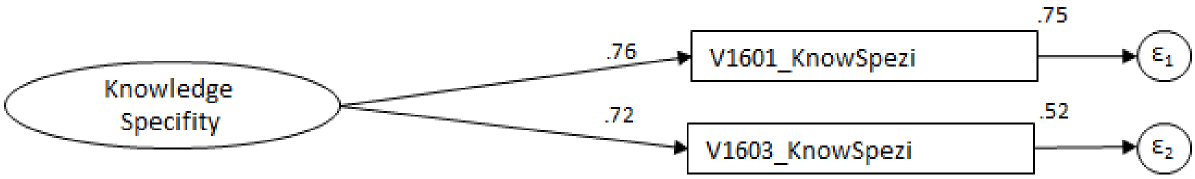
χ^2	.142	χ^2/ df	.142	TLI	1.005	RMR	.008
df	1	GFI	1.000	CFI	1.000	RMSEA	.000
p - value	.707	AGFI	.997	NFI	1.000	CAIC	31.829

Congeneric Measurement Model – Knowledge Complementarity



χ^2	.150	χ^2/ df	.150	TLI	1.007	RMR	.004
df	1	GFI	1.000	CFI	1.000	RMSEA	.000
p - value	.699	AGFI	.997	NFI	1.000	CAIC	31.838

Congeneric Measurement Model – Knowledge Specificy



For the construct Knowledge Specificy only two items remained in the measurement model, as item V1602_KnowledgeSpeci showed a low factor score weight (β = 0.39) and thus was eliminated from the model. This was already indicated by the respectively low factor loading (β = 0.462) and poor Cronbach`s alpha value ($\alpha = 0.606$) during EFA. Even though a minimum of 3 items for each construct has been recommended in the literature (Baumgartner and Homburg, 1996), given the strong reliability and convergent validity scores for the two-item measure (refer to section 6.4.3), its suitability for further analysis was assumed. AMOS only provides goodness of fit values for models with three or more items, hence the model fit indices for Knowledge Specificy cannot be reported.

As a result, all one-factor congeneric measurement models present good model fit in regard to the goodness-of-fit criteria defined for this research and qualified for the computation of composite scores, used in the final structural model.

Appendix 6.4 Procedure used for Testing Measurement Model Invariance

Both configural and metric invariance is examined by means of **multi-group path analysis**, as it allows testing if the values of model parameters vary across groups (Diamantopoulos and Siguaw, 2000, Kline, 2005). A multi-group path analysis was employed to test the final factor structure resulting from the CFA (as presented in chapter 6.4.2) by simultaneously estimating the measurement model across two groups (Byrne, 2001). Using the categorical variable *Position*, the data set was segmented into two sub-groups 'Upper Management' and 'Middle Management', to determine if the factor structure is the same across groups. The variable *Position* qualified for sub-sampling and the validation of measurement invariance, as both groups were equal in size for Upper Management (n=104) and Middle Management (n=104), and were not expected to differ in their answers.

Configural invariance implies the same number of factors in each group. It is given when the factor structure achieves adequate model fit "when both groups are tested together and freely (i.e. without constraints)" (Gaskin, 2012c). Compared to the final measurement model, the estimation of the unconstrained multi-group model shows only a minor deterioration in the fit indices. As the model fit indices for the multi-group model vs. the full measurement model show, the χ^2/df (=1.584 vs. 1.514) and RMSEA (=0.053 vs. 0.050) remained basically at the same level indicating good model fit, the GFI (=0.712 vs. 0.826), TLI (=0.863 vs. 0.936), and CFI (=0.881 vs. 0.945) decreased quite a bit and did not meet their acceptable thresholds (as presented in chapter 6.4.1), whereby the AGFI (=0.651 vs. 0. 788) and NFI (=0.738 vs. 0.855) impaired indicating poor fit. However, as most of the model fit indices are sensitive to sample size (especially the GFI, AGFI and NFI as detailed in chapter 6.4.1) rather than giving to much importance on the overall goodness of fit estimation, it was considered essential that the χ^2 statistic and the RMSEA showed good fit and only smaller difference were obtained when comparing the multi-group model to the full measurement model. Given the good values here, findings suggest that configural invariance is established across groups. However, as configural invariance is rather seen as a precondition for the metric invariance to be established, the latter is assessed subsequently.

Metric invariance implies equal factor loadings across groups, as the factor loadings indicate the strength of the causal effect of observed indicators on its latent construct (Bollen, 1989). Hence, metric invariance provides evidence that the values on the manifest indicators have the same meaning across groups (Vandenberg and Lance, 2000). Metric invariance thus can be regarded as a stricter condition of construct comparability across groups. To test for metric invariance two methods were applied: (1) the Chi-Square Difference ($\Delta\chi^2$) test, and subsequently (2) the Critical Ratio for difference test as described in the following

(1) Chi-Square Difference ($\Delta\chi^2$) Test – Middle and Upper Management Groups

In the first instance, metric invariance was tested by means of a **Chi-Square Difference ($\Delta\chi^2$) test**. The $\Delta\chi^2$-test typically comprises the estimation and comparison of two competing models in order to test whether a given model is superior to a competing model. The $\Delta\chi^2$-test is applied in a three-step approach (Byrne, 2001). First, an unconstrained multi group measurement model is estimated as described above. Second, the same model is re-estimated, after all structural regression weights have been constrained and set equal across groups. Third, the χ^2 and df of the unconstrained model are compared with those of the constrained model and the difference of $\Delta\chi^2$ and Δdf is taken. Subsequently, the significance of the $\Delta\chi^2$ is analysed with df equal to Δdf between the two models (Byrne, 2001). The result of the $\Delta\chi^2$-test are presented in the table below.

	χ^2	df	$\Delta\chi^2$	Δdf	P
unconstrained model	1936.622	1223			
fully constrained model	2010.691	1261	74.069	38	0.000

The result displays that the $\Delta\chi^2$ is statistically significant at a 0.05 level for the constrained model, indicating that the two models are different across groups. Hence, metric invariance across groups could not be established *on the model level*, which made a more detailed investigation of the significance of differences *on the path level* necessary (Byrne, 2001, Plewa and Quester, 2007).

(2) Critical Ratio for Difference Test – Middle and Upper Management Groups

If the $\Delta\chi^2$-test is found to be significant, a pair-wise parameter comparison *on the path level* is recommended by means of the **Critical Ratio for differences test**, to determine which pairs of parameters are significantly different between the two groups (Arbuckle and Wothke, 1999). Using the group analysis feature in AMOS, critical ratios for differences between every single pair of parameters are provided. To calculate the critical ratios for differences, the difference between the parameter estimates of the two groups is divided by the standard error (SE) of the difference between the two parameters. The values of the critical ratio (the z-score) and the corresponding level of significance are reported in the table below. Generally, z-values greater than the absolute value of 2 are likely to be statistical significant (Jekel et al., 2007), meaning that the respective path is significantly different across groups.

Pair-wise parameter comparison at the path level			Upper Mngmt		Middle Mngmt		z-score
			Estimate	p-value	Estimate	p-value	
V0801_Sensing	→	Sensing	1.163	0.000	1.052	0.000	-0.612
V0802_Sensing	→	Sensing	0.876	0.000	1.031	0.000	0.920
V0803_Sensing	→	Sensing	0.692	0.000	0.944	0.000	1.506
V0903_Learning	→	Learning	1.179	0.000	1.287	0.000	0.734
V0904_Learning	→	Learning	1.198	0.000	1.126	0.000	-0.507
V0905_Learning	→	Learning	1.084	0.000	1.000	0.000	-0.503

V1002__Integrating	→	Integrating	0.847	0.000	1.008	0.000	1.043
V1003__Integrating	→	Integrating	0.916	0.000	1.428	0.000	**3.109*****
V1004__Integrating	→	Integrating	1.251	0.000	1.361	0.000	0.687
V1005__Integrating	→	Integrating	1.099	0.000	1.260	0.000	0.880
V1101__Coordinating	→	Coordinating	1.198	0.000	1.109	0.000	-0.536
V1103__Coordinating	→	Coordinating	1.109	0.000	0.991	0.000	-0.775
V1104__Coordinating	→	Coordinating	1.236	0.000	1.030	0.000	-1.391
V1105__Coordinating	→	Coordinating	1.144	0.000	1.102	0.000	-0.279
V2002_NetworkOrient	→	NetwOrient	1.250	0.000	1.276	0.000	0.150
V2004_NetworkOrient	→	NetwOrient	1.432	0.000	1.137	0.000	**-1.814***
V2005_NetworkOrient	→	NetwOrient	1.379	0.000	1.357	0.000	-0.126
V2006_NetworkOrient	→	NetwOrient	1.389	0.000	1.242	0.000	-0.821
V2103_EnvTurb	→	EnvTurb	0.993	0.000	0.825	0.000	-0.961
V2104_EnvTurb	→	EnvTurb	1.117	0.000	1.184	0.000	0.353
V2105_EnvTurb	→	EnvTurb	1.481	0.000	1.261	0.000	-1.146
V2302_EntreOrient	→	EntreOrient	1.004	0.000	1.214	0.000	1.158
V2303_EntreOrient	→	EntreOrient	1.181	0.000	1.217	0.000	0.189
V2304_EntreOrient	→	EntreOrient	1.169	0.000	1.309	0.000	0.674
V1201_BreadthMarket1	→	MarketKnow	1.044	0.000	1.045	0.000	0.006
V1202_BreadthMarket2	→	MarketKnow	1.157	0.000	0.998	0.000	-1.202
V1301_DepthMarket1	→	MarketKnow	0.717	0.000	0.947	0.000	1.578
V1203_BreadthTech1	→	TechnoKnow	1.180	0.000	1.296	0.000	0.850
V1204_BreadthTech2	→	TechnoKnow	1.153	0.000	1.315	0.000	1.188
V1303_DepthTech1	→	TechnoKnow	0.735	0.000	1.302	0.000	**3.664*****
V1501_KnowTacit	→	KnowTacit	1.587	0.000	1.534	0.000	-0.277
V1502_KnowTacit	→	KnowTacit	1.617	0.000	1.687	0.000	0.386
V1504_KnowTacit	→	KnowTacit	1.465	0.000	1.438	0.000	-0.150
V1701_KnowCompl	→	KnowCompl	0.815	0.000	1.025	0.000	**1.663***
V1702_KnowCompl	→	KnowCompl	0.869	0.000	1.113	0.000	**1.852***
V1703_KnowCompl	→	KnowCompl	1.057	0.000	0.990	0.000	-0.495
V1603_KnowSpeci	→	KnowlSpeci	0.968	0.000	0.800	0.000	-1.057
V1601_KnowSpeci	→	KnowlSpeci	0.837	0.000	1.128	0.000	**1.781***

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level

The results of the pair-wise parameter comparison show that for scattered paths significant differences across groups are given (as highlighted in bold). However, following MacKenzie et al. (2011, p. 325) “full metric invariance is not necessary for further tests of invariance and substantive analyses to be meaningful, provided that at least one item [per construct] is metrically invariant". This means that for metric invariance to be established, a minimum of one item per construct is required to show no significant differences (Gaskin, 2012c). As indicated by the non-significant z-values shown in the table above, for each construct the vast majority of items show to be metric invariant, meaning that there is no significant difference across groups (Gaskin, 2012c). Hence, metric invariance could be established *at the path level*, meaning that the two groups are sufficiently invariant with regard to the overall factor structure.

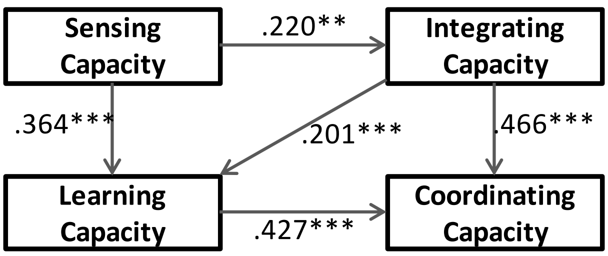
Appendix 6.5 Effects, Critical Ratios and Hypotheses Tests - Conceptual Model

Hyp.	Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio	Support
			Direct	Indirect	Total		
H1	TechnoKnowledge	RR	0.228	0.000	0.228	3.824***	YES
H1_1	Market Knowledge	RR	n.p.	0.073	0.073	n.p.	(Yes)
H2	Sensing capacity	RR	n.p.	0.180	0.180	n.p.	(Yes)
H2a	Sensing capacity	Market Knowledge	0.167	0.141	0.308	2.197*	YES
H3	Learning capacity	RR	n.p.	0.191	0.191	n.p.	(Yes)
H3a(1)	Learning capacity	TechnoKnowledge	0.391	0.139	0.530	6.614***	YES
H3a(2)	Learning capacity	Market Knowledge	0.360	0.000	0.360	4.749***	YES
H2/3b	Market Knowledge	TechnoKnowledge	0.378	0.000	0.378	6.393***	YES
H4	Integrating capacity	RR	0.311	0.146	0.457	4.487***	YES
H5	Coordinating capacity	RR	0.323	0.000	0.323	4.192***	YES
H6a	EO	Sensing capacity	0.162	0.000	0.162	2.653**	YES
H6b	EO	Learning capacity	0.163	0.094	0.257	3.081**	YES
H6c	EO	Integrating capacity	0.142	0.034	0.176	2.278*	YES
H6d	EO	Coordinating Capa.	0.036	0.173	0.209	0.799	NO
H7a	NO	Sensing capacity	0.455	0.000	0.455	7.430***	YES
H7b	NO	Learning capacity	0.214	0.225	0.439	3.545***	YES
H7c	NO	Integrating capacity	0.299	0.094	0.393	4.319***	YES
H7d	NO	Coordinating Capa.	0.032	0.333	0.365	0.645	NO

*** p<0.001; ** p<0.01; * p<0.05; Results are based on Bootstrap = 500; 95% confidence level
n.p: not measured, only an indirect effect was expected, which is tested separately in section 6.6
(Yes): The indirect effect is significant at a 0.05 level

Appendix 6.6 Interrelations between Dynamic Capabilities

Presented below are the interrelations between Sensing, Learning, Integrating and Coordinating capacities, which are a constituent part of the structural model (refer to chapter 3.4.1.6).



Independent Variable	Dependent Variable	Standardised Effects			Critical Ratio
		Direct	Indirect	Total	
Sensing Capacity	Learning Capacity	0.364	0.044	0.408	6.102***
Sensing Capacity	Integrating Capacity	0.220	0.000	0.220	3.141**
Sensing Capacity	Coordinating Capacity	0.000	0.276	0.276	/
Learning Capacity	Coordinating Capacity	0.427	0.000	0.427	8.008***
Integrating Capacity	Learning Capacity	0.201	0.000	0.201	3.467***
Integrating Capacity	Coordinating Capacity	0.466	0.086	0.552	9.431***

*** p<0.001; ** p<0.01; * p<0.05

Findings revealed that Sensing capacity has a significantly influence on Learning capacity (ß= 0.364, p<0.001) and Integrating capacity (ß = 0.220, p<0.005), therewith confirming what theory suggested (see Lichtenthaler, 2012 and Pavlou and El Sawy, 2011). Moreover in line with Pavlou and El Sawy (2011) a strong positive effect of Integrating capacity on Coordinating capacity could be confirmed with a beta coefficient of 0.466 (p<0.000). Besides also Learning capacity emerged to have a strong positive effect on Coordinating capacity as suggested by theory (ß= 0.427, p<0.000). Interestingly, moreover Integrating capacity was found to positively influence Learning capacity (ß = 0.201, p< 0.005).

Appendix 6.7 Mediating Role of the Dynamic Capabilities between Entrepreneurial and Networking Orientation and Resource Recombination

The results as presented in the table below give support to the following proposition:

Sensing capacity positively and partially mediates the (positive) relationship between EO and Market Knowledge (p<0.05), and positively and indirectly effects the (positive) relationship between NO and Market Knowledge (p<0.05)

Learning capacity positively and partially mediates the (positive) effect of EO on Market Knowledge (p<0.05), and fully mediates the (positive) effect of EO on Technological Knowledge (p<0.05). Furthermore, Learning capacity positively and fully mediates the (positive) effect of NO on Market Knowledge (p<0.05) and NO on Technological Knowledge (p<0.05).

Integrating capacity positively and partially mediates the (positive) relationship between NO and RR (p<0.05). At the same time Integrating capacity only indirectly affects the relationship between EO and RR, meaning that EO influences RR only indirectly through Integrating capacity (p<0.05). Interestingly, there is no initial direct relationship between EO and RR.

Coordinating capacity does not mediate the relation between EO and RR, neither does it mediate the relation between NO and RR. No significant relationship could be found between EO, Coordinating capacity and RR (neither direct nor indirect). Although, there is a positive and significant direct effect from NO to RR, Coordinating capacity does not mediate this effect (as Integrating capacity does). However, at the same time NO turned out to have a strong direct effect on RR. While Integrating capacity positively and indirectly effects the relationship between EO and RR, Coordinating capacity does not.

Hyp.	Causal Chain	Model without Mediator (A)	Model with Mediator (B)		Mediation type observed
		Direct Beta w/o med (p-values)	Direct Beta w/ med (p-values)	Indirect Beta (p-values)	
H6a	EO → Sens → Mknowl	.169* (.011)	.160* (.015)	.107** (.003)	**partial mediation**, as both the direct & indirect effects are significant
H7a	NO → Sens → Mknowl	0.088 (.228 - ns)	.048 (.514 - ns)	.154** (.003)	**indirect effect**, (no mediation), as both direct effects are not significant, but indirect effect is strong and significant.
H6b (2)	EO → Learn → Mknowl	.229***(.000)	.159* (.015)	.051**(.001)	**partial mediation**, as both the direct & indirect effects are significant
H6b (1)	EO → Learn → Tknowl	.202***(.000)	.110 (.57-ns)	.081**(.001)	**full mediation**, with moderate and significant indirect effect
H7b (2)	NO → Learn → Mknowl	.154 *(.039)	.049 (.514 - ns)	.075*(.010)	**full mediation**, with moderate and significant indirect effect
H7b (1)	NO → Learn → Tknowl	.211*** (.000)	.053 (.403 -ns)	.110** (.008)	**full mediation**, with strong and significant indirect effect
H6c	EO → Integ → RR	.073 (.185 -ns)	.061 (.247 - ns)	0.065*(.022)	**indirect effect** (no mediation), as both direct effects are not significant, but indirect effect is significant, but only weak
H7c	NO → Integ → RR	.247***(.000)	.212***(.000)	.131**(.005)	**partial mediation**, with strong and significant indirect effect
H6d	EO → Coord → RR	.075 (.171 -ns)	.062 (.247- ns)	.010 (.454- ns)	**no mediation**, as the EO → Coord. relation and as a result also the indirect effect are not significant
H7d	NO → Coord → RR	.239***(.000)	.214***(.000)	.009 (.524 - ns)	**no mediation**, as the NO → Coord. relation and as a result also the indirect effect are not significant; NO however has a strong direct effect on RR

Appendix 6.8 Critical Ratios for Differences Test – Integrating and Coordinating Capacity

The table presents the estimates Critical Ratio for differences (z-score) with indications of significance for all the paths in the model (p-values). The z-score is a statistic provided by AMOS for testing the hypothesis that two parameters in the model are equal across groups. Based on these values the same paths could be confirmed to be significantly different across groups as indicated by the stepwise Chi-Square Difference Test (refer to chapter 6.7.1).

Independent Variable	Dependent Variable	Coordinating_low [1]		Coordinating_high [2]			Integrating_low [1]		Integrating_high [2]		
		Estimate	P	Estimate	P	z-score	Estimate	P	Estimate	P	z-score
V2300_EntreOrientFact	V0800_SensingFact	0.133	0.158	0.026	0.756	-0.842	0.213	0.043	0.054	0.491	-1.212
V2000_NetwOrientFact	V0800_SensingFact	0.206	0.050	0.321	0.000	0.873	0.253	0.008	0.379	0.000	0.958
V2000_NetwOrientFact	V1000__IntegratingFact	0.167	0.102	0.247	0.006	0.590	-0.010	0.892	0.111	0.005	1.459
V2300_EntreOrientFact	V1000__IntegratingFact	0.104	0.253	-0.088	0.307	-1.533	0.058	0.461	-0.004	0.896	-0.734
V2300_EntreOrientFact	V0900_LearningFact	0.122	0.186	0.135	0.028	0.122	0.231	0.019	0.200	0.003	-0.253
V2000_NetwOrientFact	V0900_LearningFact	0.179	0.088	0.227	0.000	0.386	0.130	0.153	0.173	0.053	0.332
V0800_SensingFact	V1200_MarketKnowlFact	0.288	0.026	0.061	0.665	-1.191	0.202	0.107	0.118	0.340	-0.478
V0900_LearningFact	V1200_MarketKnowlFact	0.223	0.083	0.262	0.088	0.199	0.416	0.000	0.261	0.034	-0.900
V2300_EntreOrientFact	V1200_MarketKnowlFact	0.107	0.264	0.116	0.195	0.072	0.048	0.629	0.148	0.102	0.743
V1200_MarketKnowlFact	V1300_TechnoKnowlFact	0.432	0.000	0.264	0.012	-1.023	0.432	0.002	0.330	0.000	-0.613
V0900_LearningFact	V1300_TechnoKnowlFact	0.469	0.000	0.232	0.039	-1.386	0.459	0.000	0.376	0.000	-0.521
V1300_TechnoKnowlFact	**V1800_RR_Composit**	0.118	0.092	0.309	0.000	**1.65***	0.072	0.275	0.268	0.001	**1.854***
V1100__CoordinatingFact	**V1800_RR_Composit**	0.062	0.658	0.082	0.681	0.080	0.143	0.091	0.417	0.000	**1.955***
V1000__IntegratingFact	**V1800_RR_Composit**	0.114	0.227	0.414	0.000	**2.415****	0.060	0.590	-0.065	0.768	-0.508
V2000_NetwOrientFact	V1800_RR_Composit	0.168	0.025	0.168	0.002	0.001	0.165	0.007	0.121	0.070	-0.487

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

[1] **low:** between 0 and mean minus 0,5 SD

[2] **high:** between mean plus 0,5 SD and 7

Appendix 6.9 Comparison of Regression Weights for the Indirect Effect

Aditionally an analysis of the indirect (mediating) effects was conducted for Integrating capacity low vs. high, and Coordinating capacity low vs. high, the results are presented below.

Sectio A - Results for low Integrating Capacity

Hyp	Relationship	Model without Mediator (A)	Model with Mediator (B)		Mediation type observed
		Direct Beta w/o med (p-values)	Direct Beta w/ med (p-values)	Indirect Beta (p-values)	
	(1) Sens → Mknowl → Tknowl →RR	.229* (0.054)	.209 (0.091-ns)	.006 (.480 - ns)	**no mediation**
	(2) Learn → Mknowl → Tknowl →RR	.102 (.532 -ns)	-.013 (.943 -ns)	.124(.138 - ns)	**no mediation**

Section B - Results for high Integrating Capacity

Hyp	Relationship	Model without Mediator (A)	Model with Mediator (B)		Mediation type observed
		Direct Beta w/o med (p-values)	Direct Beta w/ med (p-values)	Indirect Beta (p-values)	
	(1) Sens → Mknowl → Tknowl →RR	.128 (.179 - ns)	.125 (.174 - ns)	.012(.223 - ns)	**no mediation**
	(2) Learn → Mknowl → Tknowl →RR	.144 (.220 - ns)	.056 (.633 - ns)	.181**(.002)	**Indirect effect**

Section C - Results for low Coordinating Capacity

Hyp	Relationship	Model without Mediator (A)	Model with Mediator (B)		Mediation type observed
		Direct Beta w/o med (p-values)	Direct Beta w/ med (p-values)	Indirect Beta (p-values)	
	(1) Sens → Mknowl → Tknowl →RR	.147 (0.253 - ns)	.096 (0.466 - ns)	.020 (.127 - ns)	**no mediation**
	(2) Learn → Mknowl → Tknowl →RR	.118 (.429 - ns)	0.020 (.900 - ns)	.099(.057 - ns)	**no mediation**

Section D -Results for high Coordinating Capacity

Hyp	Relationship	Model without Mediator (A)	Model with Mediator (B)		Mediation type observed
		Direct Beta w/o med (p-values)	Direct Beta w/ med (p-values)	Indirect Beta (p-values)	
	(1) Sens → Mknowl → Tknowl →RR	.128 (.179 - ns)	-.006 (.947 - ns)	.004 (.698 - ns)	**no mediation**
	(2) Learn → Mknowl → Tknowl →RR	.190 (.057 - ns)	.143 (.125 - ns)	.102**(.008)	**Indirect effect**

The results of the comparison of regression weights for the indirect effect further support the suggestions of moderated mediation being in place. The findings reveal that the mediating role of Technological Knowledge did not hold up for those firms with low Coordinating and Integrating capacities, as in both cases the indirect effect turned to be insignificant (p> 0.05, see Appendix 6.9, section a and c). In terms of size, the differences between the two groups in this example are not large, however it can be seen that for firms having high Integrating capacities the indirect effects between Sensing and RR (through Market and Technological Knowledge) as well as between Learning and RR (through Market and Technological Knowledge) is stronger than it is under conditions of low integration. Interestingly, under conditions of low resp. high Coordination this is not the case. Furthermore, while under conditions of high Integration and high Coordination the indirect effect of Learning on RR (through Market and Technological Knowledge) revealed significant at a 0.05 level as expected, it has to be noted that the indirect effect between Sensing and RR (through Market and Technological Knowledge) did not emerge as significant. However, this lack of ratification might simply be caused by the small sample size of the sub-groups. Overall, findings support the hypothesis that moderated mediation is in place

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